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ABSTRACT

Discussed is the development of an energy management program for New York State's school buildings and related facilities by Educational Facilities Laboratories (EFL). Based upon a prior assessment of the need and potential for an energy conservation program, EFL identifies six recurring concerns regarding the establishment of such programs. The model program presented is designed to deal with these common problems. Among the goals of this energy conservation program are: (1) increased awareness of and participation in energy conservation, (2) establishment of energy use goals for each building, (3) operation of all buildings at or below these use goals, (4) increased energy management skills of building operators, and (5) statewide reduction of school energy consumption by 40%. Separate sections of this report describe the energy plant's goals and elements, administration, strategies, incentives, and costs. (WB)

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Model Energy Conservation Program for New York State Schools, Phase II

Report 78-7

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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Hugh L. Carey
Governor

James L. Larocca
NYSERDA Chairman

A REPORT ON THE DEVELOPMENT OF

A MODEL ENERGY MANAGEMENT PROGRAM

for

NEW YORK STATE SCHOOLS

PHASE II

Report 78-7

PREPARED FOR THE

NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY

By

EDUCATIONAL FACILITIES LABORATORIES, INC.

August 1978

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A REPORT ON THE DEVELOPMENT OF

A MODEL ENERGY MANAGEMENT PROGRAM

for

NEW YORK STATE SCHOOLS

PHASE II

EXECUTIVE SUMMARY

BACKGROUND

In January, 1977, The New York State Energy Research and Devlopment Authority contracted with Educational Facilities Laboratories, Inc. to develop a comprehensive energy conservation program for New York State Schools. The goal of the program was, and continues to be, the reduction of statewide energy consumption in all public schools and school related buildings.

EFL's study was conducted in two phases. Phase I focused on adapting for use in New York State the data collection instruments, computer based analytical models, and energy analysis procedures developed by EFL in its Public Schools Energy Conservation Service. Data analyzed for 22 New York State school districts revealed both a great need and a great potential for energy savings. An average energy savings of 32 percent at the elementary level, and 26 percent at the secondary level appeared possible through enactment of minor operational and maintenance adjustments. These figures represent an annual savings of $32,000,000, (1.3 million barrels of fuel and 312 million KWH) with no capital expenditures required. Data indicated the possibility of additional savings for some schools through more extensive building and mechanical systems modifications. These improvements would require capital funding.

GOALS AND OBJECTIVES

With need and potential confirmed, Phase II was undertaken to establish the framework for the energy management program and to evluate the techniques employed in Phase I. The objectives of Phase II were as follows:

A. Identify impediments to the implementation of energy conservation measures, and outline measures for their resolution.

B. Develop and test an energy conservation monitoring system capable of providing monthly guideline information for school buildings.

C. Research and develop incentive options to stimulate energy conservation efforts by school districts.

D. Determine the need for training programs to assist school districts and building personnel in meeting conservation goals, and determine the most appropriate methods for providing such training.

E. Prepare final recommendations for a statewide energy conservation service for schools.

In evaluating the effectiveness of Phase I materials and results, EFL surveyed all 22 participating districts, and conducted on site interviews with many participants. A review of data obtained in these investigations indicated six common concerns related to the establishment of successful energy management programs. These were:

1. The need for School Board and Superintendent commitment to energy management.

2. The need for broad based energy committees with clearly defined responsibilities.

3. Need for a long term energy management plan.

4. Need for qualified, trained personnel.
5. Need for adequate funding for energy management programs.
6. The need for qualified experts to extend staff capabilities.

ELEMENTS OF THE PROGRAM

The essential elements of a successful energy management program were developed as a response to the common concern expressed by the school districts. These eight elements are shown in Figure I, and described on the following pages.

A. Commitment to Established Goals by Top Level Authority With Involvement on all Levels

Energy conservation efforts have not received high priority in the past, and will not in the future, without strong commitment and active participation by all members of the school community. To secure commitment at all levels, it is recommended that energy management plans be officially adopted by the concerned governing bodies of both the state and the district. A series of advisory committees should be established to provide input from the various groups participating in, or affected by the energy program.

B. A Clearly Defined Organization and Communication Structure

Wherever possible, the administrative structure proposed for this program makes use of existing organizational structures. These are strengthened by the addition of energy coordinators at the state and regional levels. The proposed organizational structure is shown in Figure II.

FIGURE I

THE ESSENTIAL ELEMENTS IN THE NY STATE
ENERGY MANAGEMENT PROGRAM

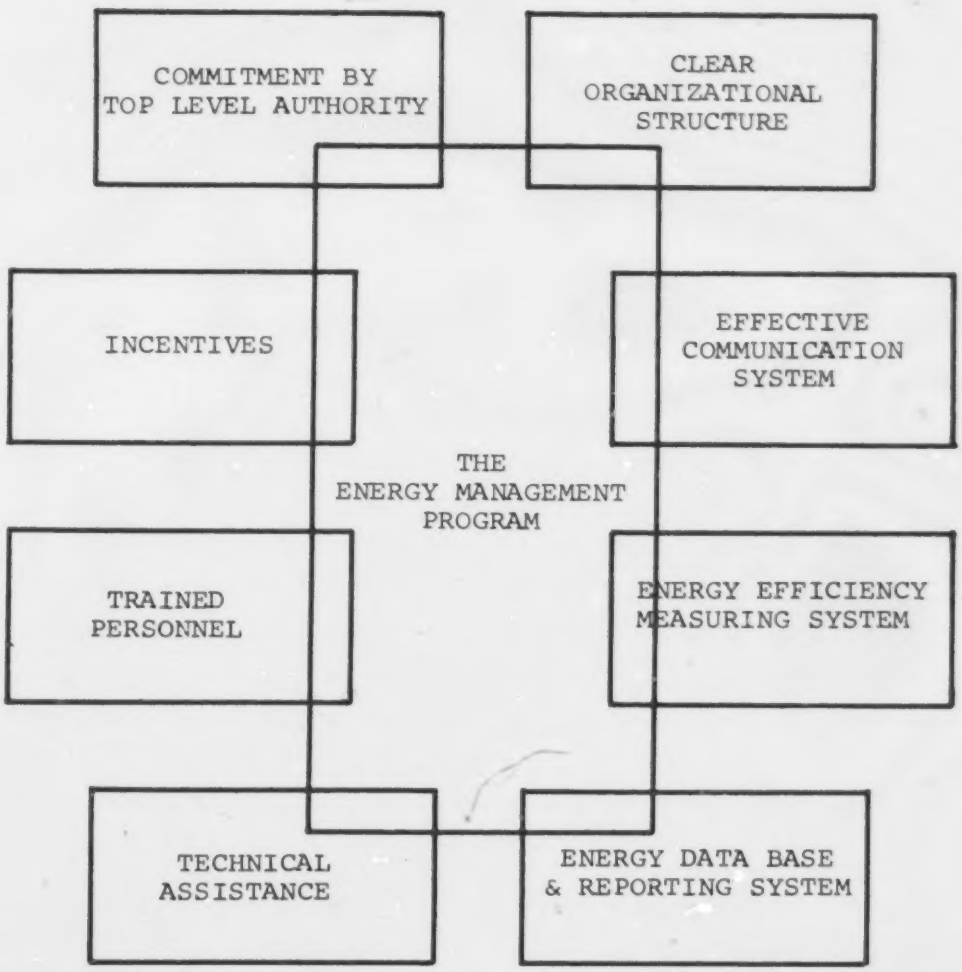
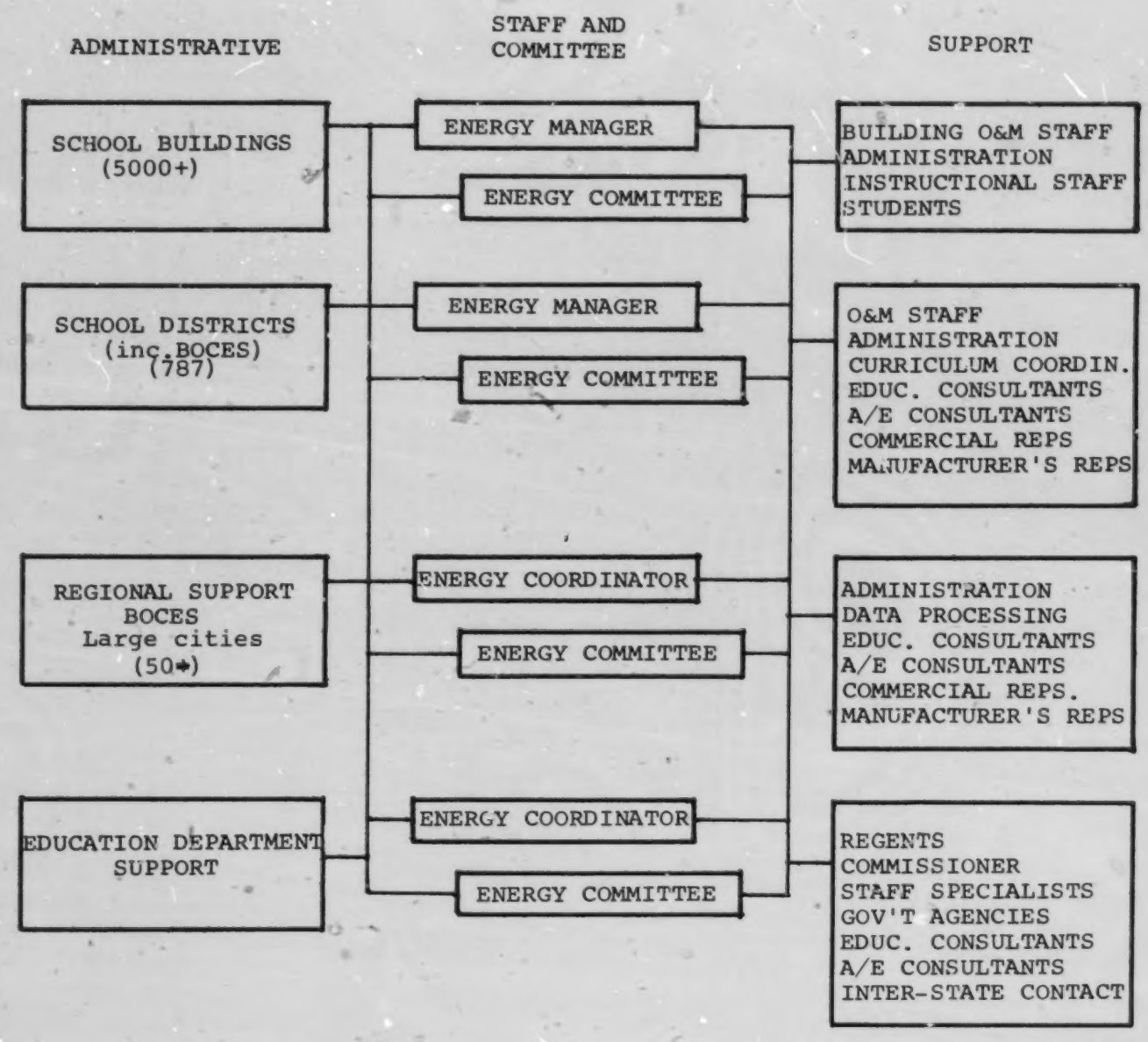


FIGURE II

PROPOSED ORGANIZATIONAL STRUCTURE

ENERGY MANAGEMENT PROGRAM
FOR
NEW YORK STATE PUBLIC SCHOOLS



1. Staff Structure

a) State Elementary and Secondary School Energy Coordinator.

The state coordinator in charge of the program for the state will assist regional coordinators, act as liaison between the state, regions and school districts, and monitor the progress of the program.

b) Regional Energy Coordinators

Many regions are too small to support a full time time energy coordinator and may wish to establish a part time position or combine with other regions. The primary responsibilities of a regional coordinator are to assist districts in their management efforts, coordinate the activities of districts in the region, and establish training programs for the region.

c) District Energy Managers

The district energy manager will be directly responsible for implementation of the district's energy program.

d) Building Energy Manager

Building energy managers will be directly responsible for energy management at the building level.

2. Committee Structure

The committee structure is designed to parallel and supplement the staff structure at each of the four levels: state, regional, district and school.

C. An Energy Efficiency Measurement System

A major obstacle to the successful energy management programs of many school districts is the lack of standard efficiency measurements with which to compare their plants.

This obstacle can be removed by establishing energy use goals using one of the existing EFL developed computer analysis programs.

D. Energy Data Base and Reporting System

Keeping records of energy data is essential for monitoring local, regional and statewide progress toward attainment of program goals. Various types of energy audits provide the data for these records.

1. Preliminary Energy Audits

A preliminary energy audit provides the information vital to developing an energy management plan for each school. Preliminary audits for 60 percent of the elementary and secondary schools should be completed by the end of the first year of the program. The remaining audits should be completed in the second year.

2. Monthly Monitoring

Two types of monthly monitoring are proposed for this program:

a) A manual record keeping system, whereby energy use is charted on a monthly basis and comparisons are drawn with the same month of the previous year.

b) A monthly goal analysis program utilizing the Monthly Comparison Report (MCR1) computer program. This computer program generates monthly energy use guidelines which enable a district to compare actual and guideline energy use each month, thus effectuating more rapid assessment of needed operational and physical modifications.

E. Technical Assistance

1. Professional Consultants

As the program develops, the need will arise to engage

professional consultants to assist in training regional coordinators, prepare plans for retrofit programs, and make detailed energy audits. State and regional coordinators will be responsible for identifying persons and firms capable of providing the required services. One such service is the maxi audit.

2. Maxi Audit

The maxi audit is a comprehensive examination of energy use patterns in a school building. It is undertaken only after results from the preliminary audit have been received and acted upon. The audit is usually conducted by a professional consultant who examines the physical plant, its operational systems, energy use patterns and historic energy consumption. This process is essential in determining the cost effectiveness of proposed modifications.

F. Trained Personnel

The success or failure of energy management is dependent in large measure on the skills and abilities of the energy managers. Few of the individuals who will operate in that capacity have received formal training in energy management, yet many of the activities recommended in this plan require special training. Training must therefore be provided as a part of the energy management program. A workshop program is proposed to meet this need.

1. Phase I Workshops - State and Regional Personnel

The first workshop will familiarize state and regional personnel with the State Energy Management Program and will instruct them in energy audit procedures and data gathering.

Workshop #2 provides training to Lead Data Center personnel in the operation of the GAP4 computer program.

Workshop #3 provides training to Regional Data Processing Center personnel in the operation of the MCR1 computer program.

2. Phase II Workshops - District Personnel

These workshops, organized by the regional energy coordinators, will familiarize district personnel with the State Energy Management Plan, and will instruct them in the techniques and procedures for conducting preliminary audits.

Additional workshops in such areas as boiler operation controls, efficiency testing, lighting, record keeping, etc, will be added as the need arises.

G. Incentives

Incentive programs are essential for promoting dedicated participation in energy management programs. These programs fall into two categories: 1) those designed to encourage district participation in energy management programs, and 2) programs instituted by districts to encourage active participation in district programs.

1. Programs to Encourage District Participation

The predominant incentive for most school districts is financial. This may take several forms including:

a) Federal Assistance

Although it is still pending legislation, the proposed Schools and Hospitals Grants Program has already stimulated many districts to undertake energy audits in anticipation of receiving funds.

The Federal Government is presently providing funds to the New York State Energy Office for other

conservation programs. A portion of these may be available for school district energy conservation programs.

b) State Assistance

While financial assistance seems to provide the greatest incentive, various non-monetary assistance programs have also been successful. These include support services such as workshops and technical assistance.

2. District Incentive Programs

District incentive plans have encouraged participation with both monetary rewards and recognition.

a) Monetary Rewards

To encourage energy savings, a number of districts have allowed schools which reduced their energy use over the base year, to share in the savings. There are many problems with this system due to variations in climate, school population, operating schedule, and initial efficiency. All of these affect energy savings.

Decentralized budgeting is a more sophisticated reward system, under which each school principal is given a fixed budget with which to operate his school. Money spent on non-instructional items like utilities, reduces the amount available for instruction. This encourages saving in non-instructional areas.

b) Recognition

Although monetary rewards are often effective in the short term, long term efficiency can only be sustained through the efforts of dedicated and skilled energy managers. Conscientious effort should bring recognition

to both the individuals and the institutions responsible for outstanding efforts in energy management. The public recognition of such efforts by the school board and top level administration through the granting of energy efficiency awards, will have the added effect of dramatizing the support of top level authority for the program.

COST OF THE PROGRAM

Personnel constitutes a major portion of the cost for the Energy Management Program. No attempt has been made to estimate personnel costs at the district level, because each district may handle the position of district energy manager differently.

Staff requirements at the state and regional levels have been kept to a minimum. For budgeting purposes, a figure of 33 Regional Energy Assistance Centers has been estimated. The budget can be adjusted when a more exact number has been determined.

A. Initial Start Up Cost - Year One

The first year of the program is devoted to organization, training, plan development and energy audits. In addition to personnel costs, the principle expenditures for this phase of the program are for start up workshops and the preliminary audit program. The first year's cost is estimated to be $2,418,500 including staffing for 33 Regional Energy Assistance Centers. EFL's Phase I study projected a possible savings of $4,900 per elementary school and $14,100 per secondary school through changes in operation. Total cost avoidance for New York State's elementary and secondary schools is estimated at $10,933,000. Subtracting the cost of operational modifications yields a possible cost avoidance of $8,713,000 for year one.

B. Ongoing Costs - Years Two and Three

By the beginning of Year Two, the majority of school districts should have completed preliminary audits and instituted measures to bring their schools within guideline levels. Support personnel costs will remain approximately the same as in Year One, but districts will incur additional consultant costs as they begin maxi audits and construction. Total program cost for Year Two is estimated at $1,859,000.

As for Year One, major savings during Year Two will be obtained through improved operations. Total cost avoidance is estimated at $15,810,000. Subtracting operational modification costs yields a possible cost avoidance of $12,510,000.

By the beginning of Year Three, all school districts should be operating within their guideline levels. Costs will be incurred in revising and upgrading initial audits, presenting additional workshops, and instituting capital improvements for increased energy efficiency. Total program cost for Year Three is estimated at $1,285,500.

Although buildings should be operating at or near guideline, not all buildings will be operating efficiently. This is taken into consideration in estimating savings for Year Three. Total cost avoidance is estimated at $23,690,000. Subtracting program and operational modifications costs yields a possible cost avoidance of $21,395,000.

Summary of Three Year Program Costs

The program cost, exclusive of district personnel costs for the three year period is $5,563,200. Estimated cost avoidance for the same period is $42,618,000 - a return on investment of more than 7 to 1. This does not include savings that will be realized as a result of the capital improvements made to improve energy efficiency during this period. A summary of program cost is shown on the following page.

BUDGET SUMMARY *

	YEAR			
	1	2	3	Total
State Personnel				
State Energy Coordinator	$ 30,000	$ 30,000	$ 30,000	$ 90,000
Energy Engineer	22,000	22,000	22,000	66,000
Support Staff	6,000	6,000	6,000	18,000
Regional Personnel				
Coordinator	$660,000	$660,000	$660,000	$1,980,000
Support Staff	165,000	165,000	165,000	495,000
Energy Audits				
Annual	$1,275,200	$746,000	$210,000	$2,231,200
Monthly	52,000	80,000	80,000	212,000
Workshops	$ 208,500	$150,000	$112,500	$ 471,000
Total Program Cost	$2,418,700	$1,859,000	$1,285,500	$5,563,200
Estimated Cost Avoidance (operations)	$8,713,000	$12,510,000	$21,395,000	$42,618,000

*This budget summary, Table 5, is described further beginning on page 66.

CHAPTER I

INTRODUCTION

1.01 SCOPE

In January 1977, Educational Facilities Laboratories, Inc. (EFL) entered into a contract with the New York State Energy Research and Devlopment Authority, for the purpose of developing recommendations for comprehensive energy conservation services for New York State's public elementary and secondary schools.

The goal was, and continues to be, a reduction in the consumption of energy in all public schools and school related buildings in New York State. Suggestions for the development of a program leading to the realization of this goal are the subject of this report.

The study was conducted in two phases. Phase I concentrated on the problems of using the data collection instruments, computer based analytical models and energy analysis procedures developed by EFL as a part of the Public Schools Energy Conservation Service (PSECS), in a representative sample of school districts. Data collected from these districts also provided a basis for estimating the magnitude of the energy efficiency problems in New York schools.

Subsequently Phase II was undertaken to provide an opportunity for evaluation of the initial program techniques and the development of an energy management program.

1.02 PHASE I

A. Objectives of Phase I - The primary objectives of the first phase of the study were to:

1. Test the effectiveness of various modifications to the PSECS process in the context of a variety of New York State school systems
2. Provide a learning experience for those responsible for implementing energy conservation programs
3. Provide data and experience useful in planning and implementing a state-wide energy conservation program for schools

B. Tasks of Phase I - In order to accomplish the objectives of the first phase, the following primary tasks were specified:

1. Identify a representative group of school districts, rural, suburban and city, for participation in the project.
2. Meet with key administrators and building principals to familiarize them with the project.
3. Enroll all schools of participating districts in PSECS.
4. Provide data collection forms and assistance to all districts.
5. Perform operational energy audits on all schools using the PSECS computer program (GAP2).
6. Provide each school district with energy reports, and assist in interpreting results.
7. Provide self-audit material, and assist with on site audits.
8. Conduct information meetings for school personnel.

9. Assist districts in implementation of recommendations.
10. Provide data collection forms and assistance for Capital Audits.
11. Provide Capital Audits for each school, using the EFL Capital Improvement Program (CIP2).
12. Assist districts in determining capital improvements programs and budgets.

C. Comments

During Phase I, data on 123 elementary and 46 secondary schools in 22 districts was collected. The schools were analyzed using the EFL Guideline Analysis and Capital Improvement Computer Programs, and a variety of on site audits were conducted.

An analysis of this data revealed that not only is there a great need for energy conservation, but there is also a high potential for energy savings in New York State schools. The potential energy savings for the average elementary and secondary school is shown in Figure 1.

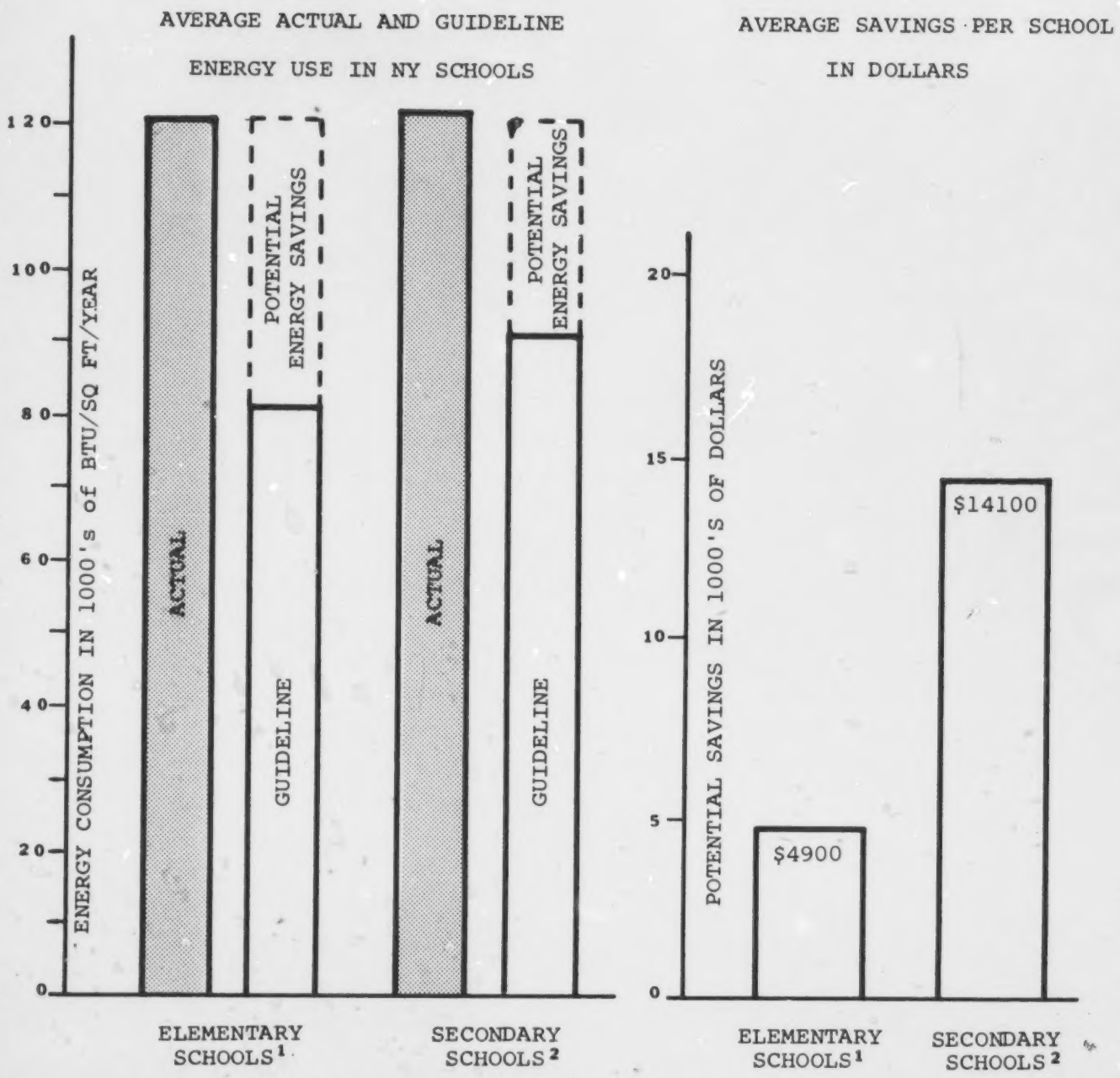
An average energy savings of 32 percent at the elementary level, and 26 percent at the secondary level appeared possible, by making simple operational and maintenance adjustments. Additional savings were found to be possible in some schools through more extensive building and mechanical systems modifications requiring capital funding.

The conclusions and recommendations developed in Phase I were presented to New York State Energy Research and Development Authority in July 1977, at which time EFL was authorized to begin a second phase study.

FIGURE 1

POTENTIAL ENERGY AND DOLLAR SAVINGS

IN NY STATE SCHOOLS



(1) Based on 113 schools in 20 districts
(2) Based on 44 schools in 15 districts

D. Phase II was devoted to evaluating the results of the first phase program and to developing, testing and refining a Monthly Energy Analysis System. Further, the study included determining the training programs needed to assist school districts and their personnel in developing energy management goals, and programs that could realize a state-wide reduction in energy use of 40 per cent over the designated base year of 1972 - 73.

1.03 PHASE II

A. Objectives and Tasks of Phase II - In order to achieve the primary objective, which was to develop recommendations for a state-wide energy management plan, the following objectives and tasks were specified:

1. Identify impediments to the implementation of energy conservation measures, and outline measures for their resolution.

   a. Identify those school districts which have followed through or intend to follow through on EFL recommendations from the initial Phase I Project.

   b. Survey those districts through site visits, to determine the effectiveness of the various recommendations.

   c. Identify districts which participated, but did not follow through with the recommendations, and determine the impediments.

   d. Summarize the results of the survey process.

   e. Make necessary modifications to procedures, programs, model and materials.

   f. Determine the need for training programs that would up-date school plant operating personnel, and the most appropriate ways of providing such training.

2. Develop and test an energy conservation monitoring system for school buildings capable of providing monthly guideline information during the heating season.

   a. Investigate existing monitoring programs such as those being developed by the North Carolina State Department of Education, Minneapolis Public Schools and The State University of New York.

   b. Develop a reporting system including computer programs, data collection procedures, and district and school evaluation procedures.

   c. Select 4 to 6 school districts from those which participated in the initial project for implementation and testing of the monitoring system.

   d. Refine the monitoring system, and document for use by local or state authorities.

3. Research and develop various incentive options that could be used in furthering energy conservation efforts by school districts.

   a. Investigate various incentive programs that have some history of success, such as the program in Rochester, New York.

   b. Investigate additional governmental programs that may be available to school districts.

   c. Define the components of a public information program that could be utilized by local districts and state agencies in building support for conservation programs.

   d. Incorporate incentives into the final energy conservation plan to be developed in the course of this project.

4. Prepare final recommendations for a state-wide energy conservation service for schools.

   a. Based on the experience and conclusions from Phases I and II, develop the objectives and components of a state-wide service that would benefit the 4,300 school buildings in New York's 730 school districts.

   b. Investigate the appropriate organizations within the State Board of Cooperative Educational Services, State Education Department, State Energy Office, State University of New York campuses, and major districts that could provide the service and/or basic data processing.

   c. Develop recommendations related to current law, or best estimate of pending legislation which, when acted upon, would make operational a state-wide service. The service is now envisioned to include guidelines analysis, capital improvements analysis, on-site audits, incentive programs, and periodic monitoring.

   d. During all stages of developing the state-wide service, work in close cooperation with the State Education Department and The State Energy Office. This close cooperation is especially important if New York State is to take early advantage of the Federal funding that may be provided to states for school energy conservation through legislation now being considered.

      NOTE: The proposed National Energy Act (NEA) includes a grants program for schools, hospitals, local government and public care buildings. The schools portion, as presently written, authorizes a three year program of matching grants for preliminary audits, technical assistance and energy conservation projects grants.

CHAPTER II

IMPLEMENTATION OF ENERGY MANAGEMENT PROGRAMS

2.01 SCOPE

In order to determine the school district's perceptions of the effectiveness of the procedures, materials, and results achieved during the Phase I test program, EFL conducted a survey of all 22 districts which participated in Phase I. The results of this survey are summarized in Appendix B.

In addition to this survey, EFL conducted many site visits in order to discuss the program with the participants. These discussions with administrative and operating personnel brought out additional information with respect to the problems of instituting energy management programs.

The results of an EFL evaluation of PSECS materials, and procedures used in its Nation-wide program closely paralleled those of the New York study. A review of the data obtained in the course of all of the investigations cited, identified six major concerns relating to the establishment of successful energy management programs. While there are undoubtably other factors that are important to the establishment of successful programs, the following were judged to be significant:

A. Needed Commitment of the School Board and Superintendent to Energy Management

School districts are organized on a fairly rigid hierarchical structure. Under this type of organization, school board members and superintendents have disproportionate influence in the determination of which programs will be

supported. If a board member or superintendent perceives energy conservation as particularly important, the likelyhood of the district making a strong commitment in this area is very high. If the board or the superintendent does not have this interest, a program is not likely to be established. Lack of commitment at the top is the surest way to dampen staff enthusiasm for any program.

The competition for the district's limited resources increases year by year. Operations and maintenance budgets are still a very small percentage of the total school budget. However, as energy costs have risen, many districts have cut back maintenance to make up the difference. This has resulted in increased inefficiency in operation and increased energy costs.

Superintendents and school boards have only recently begun to perceive the problem as important enough to initiate major energy management programs. The principal stimulus still appears to be the rapid energy price increases of the past two years. Many school boards and superintendents must still be persuaded that dollars invested in energy conservation will be cost effective.

B. Need of Broad Based Support

Broad based representation on energy committees does not appear to be the rule in the districts studied. Many districts do not use the committee structure; relying instead on the energy manager, who is given sole responsibility for the program.

The committee process can be very wasteful of manpower unless the duties and responsibilities are clearly defined, and the members feel that the activity is worthwhile.

Participation fosters commitment, which is important in a program including so many groups.

C. Need for Long Range Program

The PSECS process consists of a number of activities designed to develop a plan of action. Districts which followed through the entire process were successful in achieving results. Part of the process is designed to uncover problems.

Too many districts gathered the data, and received a computer analysis, but failed to follow through in establishing programs to verify and correct the problems.

Thirty five percent of the districts failed to perform the second on site review recommended by PSECS. This was attributable, at least in some cases, to the lack of a well thought out plan beyond that suggested in the limited material supplied as a part of the test procedures.

D. Need of Qualified Personnel

Staff training in energy management has not kept pace with the demands of the job. That there is a complete lack of understanding on the part of many well meaning operators, is evidenced in the quality of the data supplied on the PSECS data forms. This is especially critical in the building's mechanical system which is the largest energy user.

E. Need for Adequate Funding

While some districts many use this as an excuse to keep from mounting a serious program, many districts are severely limited by budget restrictions. A number of districts have

been very resourceful in obtaining funds under various government programs such as CETA, or the Public Works Act. There are basically four ways to finance energy conservation projects:

1. Pay as you go out of current operating funds
2. Bonding - this requires voter approval, and is only applicable to larger retrofit projects
3. State assistance - a portion of the latter two can be funded by New York State Education Department (up to the district's state aid ratio,) if the project has the following criteria:

   a) The modifications have less than a 10 year payback
   b) The project is more than $10,000
   c) The building is more than 20 years old

4. The repair reserve fund - a district may set aside funds anually for repair of buildings - these funds may be used for capital modifications

In the event that the National Energy Act Schools and Hospitals Program is enacted as presently written, the NEA would pay 50 percent, and the State could provide matching funds up to the district's State aid ratio.

F. Extended Staff

Small districts do not have the manpower, or the expertise to take on additional programs without assistance. Seventy-five percent of New York's school districts have six schools or less. Small districts cannot afford to employ specialists on a full time basis.

EFL has attempted to develop a plan for an energy management program that will overcome, or at least ameliorate these impediments. The activities and organizational arrangements to accomplish this objective are presented in the following chapters.

CHAPTER III

GOALS AND ELEMENTS OF THE PLAN

3.01 SCOPE

The energy management assistance program is the outgrowth of investigations conducted in accomplishing the tasks specified in Phases I and II, the authors' experience with developments in other states, and suggestions from the New York State Education Department, New York State Energy Research and Development Authority and the New York State Energy Office. It is designed to comply with the latest draft regulations governing participation in the Federal Government's proposed Schools and Hospitals Grant Program, but is in no way dependent upon the passage of the National Energy Act for its implementation.

The program focuses on assisting school authorities in establishing local programs that will meet the energy conservation goals specified in the state-wide plan, and seeks to encourage initiative in establishing local programs. The primary role of the state in this program, is to insure that districts receive the assistance they need to establish and carry out their energy management plans, to provide communication linkages to districts, and to offer support to the local level.

3.02 THE GOALS OF THE PROGRAM

Before the details of the program can be developed, there must be general agreement on the program's goals. Although the goals detailed in the following paragraphs were developed for use in the state-wide plan, they are also appropriate for adoption by the school districts as part of their own plans.

It is vital to the success of the program, that the goals established be realistic, that they be specific, and that they be such, that progress toward their achievement can be measured. The following goals meet these criteria:

A. To establish base energy use goals specific to each elementary and secondary school, measured by:

- The number of schools which have completed some form of energy audit leading to the establishment of energy use goals. (This could be either a PSECS type or one established by professional engineers.)

B. Increase the awareness of, and participation in energy conservation by students, parents, and school employees, measured by:

- Numbers of individuals in each category who participate in energy conservation programs in the first year of the plan's operation, as compared with the numbers who participate the following year

C. To operate all schools at or below their established energy use goals, measured by:

- Comparison of actual consumption with the guideline levels developed in A above. (Measurement to be taken on monthly, quarterly or yearly basis, depending on adjustment cycle.)

D. Increase energy management skills of all building operators, measured by:

1. Participation in one or more training courses
2. Participation on audit teams
3. Certification

E. To lower consumption levels by means of building modifications on all schools where such modifications show a 10 year or less payback, measured by:

- Various audit methods including PSECS, maxi audits, or engineering estimates

F. To achieve a state-wide reduction of 40 percent in energy use over the year 1972-73, measured by:

- Comparing total energy use of all elementary and secondary schools in 1972-73 with that of the first full year after this program has been in effect (Adjustments for degree days and other factors will be required.)

G. To assist development of a school board approved energy management plan by all school districts by 1979, measured by:

- Certification by City, Village and District Superintendents

3.03 ELEMENTS OF THE PLAN

The following have been determined to be the essential elements in the proposed energy management plan for New York State schools. A brief explanation of each of these elements is present here. The activities designed to support these elements are discussed in Chapter V.

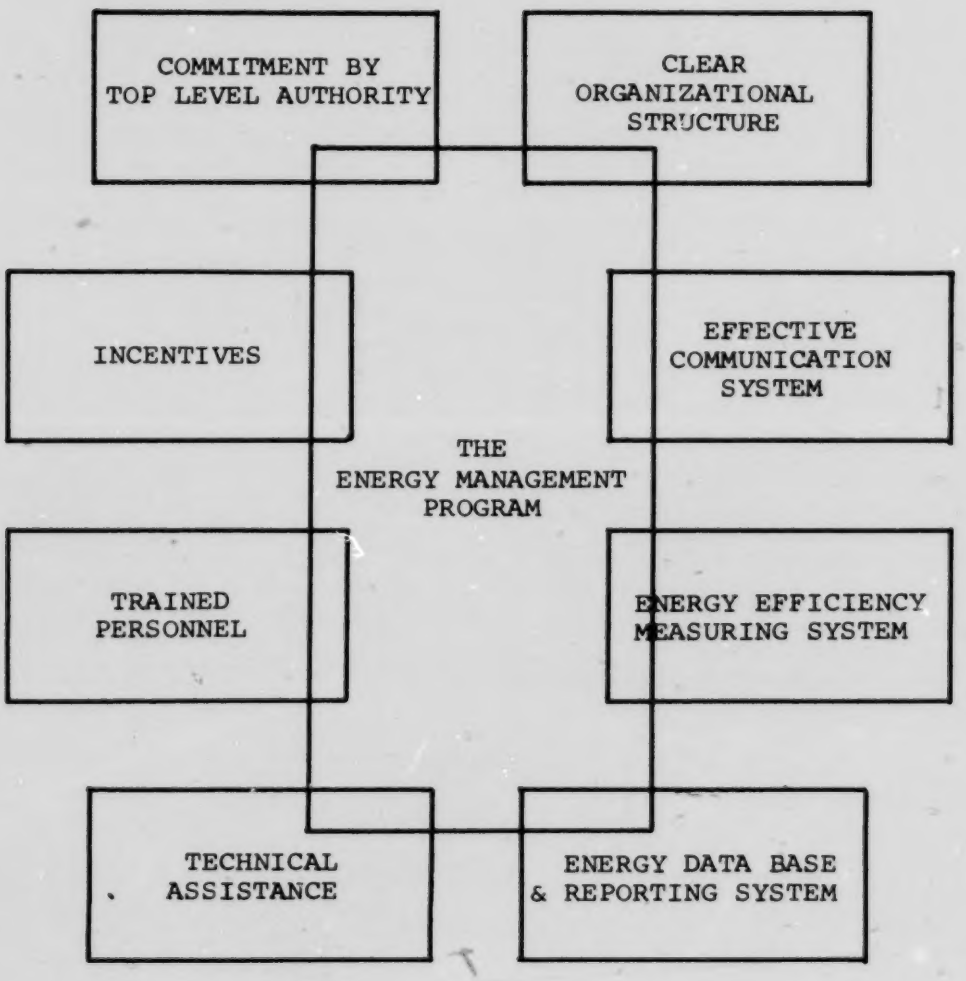
A. Commitment to Established Goals by Top Level Authority, With Involvement at all Levels

Commitment applies to all levels: the school, the district, the region and the state. Energy conservation efforts have not received high priority in the past, and will not in the future without a strong commitment by governing authorities, administrators, teachers, students and the

FIGURE 2

THE ESSENTIAL ELEMENTS IN THE NY STATE

ENERGY MANAGEMENT PROGRAM



community. In order to secure commitment at each level, it is recommended that the energy management plans be officially adopted by the governing bodies concerned. In the case of the state, this will be The State Education Department, and for the individual districts, it will be each Board of Education and Board of Cooperative Educational Service. The plans themselves will be developed by the school districts and regional energy committees using the state program as a base, with each district adding its own particular goals and activities.

Both the development and execution of the energy management program must involve those groups and individuals who are in a position to affect or be affected by the program.

While local programs are being formulated, review sessions should be provided as a forum for those who wish to express their views.

A series of advisory committees at the four levels (state, regional, district and school) are designed to provide input from a cross section of the groups which will participate in, or be affected by the energy program.

B. A Clearly Defined Organization and Communications Structure

The administrative structure proposed for the management of this program will, wherever possible make use of the existing organizational arrangements. Established channels of communication will be strengthened with the addition of energy coordinators at various levels. A detailed explanation of the proposed administrative organization appears in Chapter IV.

C. An Energy Efficiency Measuring System

A major energy management problem facing most school districts is that there are no standard measures of efficiency with which to compare the operation of their school plant.

The Energy Management Program proposes that all schools establish energy use goals, using one of the existing EFL developed computer analysis programs such as, the Guideline Analysis Program 4, or the Monthly Comparison Report (MCR), or a locally developed system. Assistance in establishing the computer generated goals will be provided by the Regional Energy Coordinator and the BOCES data processing centers.

D. Energy Data Base and Reporting System

Keeping records of energy data is an essential part of a successful energy management program. At the least, information on monthly and yearly energy use must be kept, in order to monitor the local, regional and state-wide progress in meeting the goals of the program.

Data on every school should be collected using the PSECS data forms. When completed, this information will establish district, regional and state data bases which will have the advantage of uniform construction and simple maintenance.

Such data bases will provide ready access to the kinds of data required to develop extensions of the Energy Management Program, and will provide the information needed for the Federal Government's proposed Schools and Hospitals Grants Program.

E. Technical Assistance

At the present time, many districts lack the technically trained personnel needed to implement an effective energy management program. Some of these deficiencies will be taken care of through the training efforts described below. Higher level professional services will still be necessary for some aspects of the program. Under the proposed program, The Regional Energy Coordinator will be responsible for identifying persons and firms qualified to provide the various services that may be required. Regional personnel will be assisted by the State Energy Coordinator.

F. Trained Personnel

If operating efficiencies of school buildings are to be improved, management skill of those who operate and maintain the equipment must be developed. Under the proposed program the Regional Energy Coordinator will be responsible for developing programs that will accomplish this objective. The specific means through which this goal (#4) is to be achieved will be determined by the Regional Committee working with the Regional Coordinator.

G. Incentives

Since participation in the state energy management program is to be on a voluntary basis, districts must have some incentive to participate. The most effective incentives appear to be monetary in nature, ranging from loan programs to outright grants.

The need to increase efficiency in order to reduce expenditures for energy is a natural incentive that can be used by the state to encourage participation. In addition, many districts need expert assistance and guidance in developing a program and in training their personnel. Incentives are discussed in more detail in Chapter VI.

CHAPTER IV

ADMINISTRATIVE ORGANIZATION

4.01 SCOPE

The organizational structures designed to facilitate achievement of the program's goals are shown graphically in Figure 2. The participants in the program will include:

- -3,406,015 students (K-12 and BOCES)
- -210,631 teachers and other professionals
- -4,428 public schools (K-12)
- -737 school districts
- -44 BOCES and 5 local city districts
- -11 regional BOCES data processing centers
- -2 lead data processing centers
- -N.Y. State Education Department and Division of Educational Facilities Planning
- -N.Y. State Energy Office
- -professional consultants and advisors
- -The Federal Government

4.02 ORGANIZATIONAL STRUCTURES

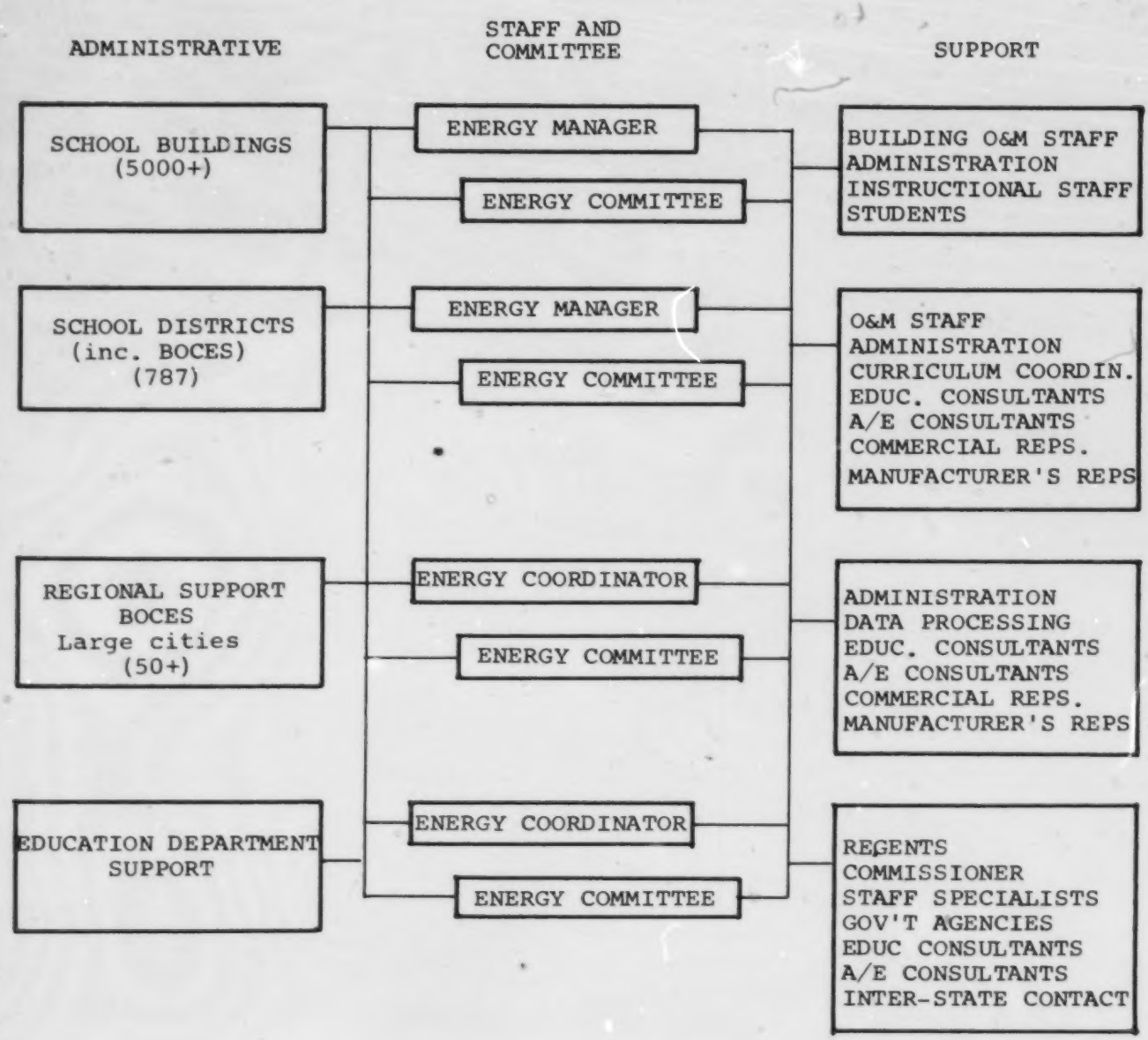
For convenience of presentation, the organizational structures proposed for this program may be separated into four components: (1) Administrative, (2) Committee, (3) Staff, (4) Technical and Educational Advisors. These four components exist in each of the four administrative levels: school, district, regional and state.

FIGURE 3

PROPOSED ORGANIZATIONAL STRUCTURE

ENERGY MANAGEMENT PROGRAM
FOR

NEW YORK STATE PUBLIC SCHOOLS



A. Administrative Structure

The administrative structure makes use of existing organizational relationships between the schools, school districts, the BOCES and the state.

The regional BOCES structure is nearly ideal, as the school districts are accustomed to working in a cooperative service mode with BOCES. Many of the BOCES have already established energy coordinator positions, and some of the BOCES have joined in sharing such services. The five large cities and larger school districts which are not represented by BOCES could each act as a separate region.

A brief description of the role of each of the participants in the administrative structure follows:

1. New York State Energy Office - Responsible for all energy conservation activities in the state. This agency will play an important advisory roll, and act as liaison between The State Education Department and The Federal Government for Federal DOE Programs
2. The State Education Department - Responsible for the development, adoption, administration and evaluation of the State Elementary and Secondary School Energy Management Program
3. Division of Educational Facilities - Has administrative responsibility for development, execution and evaluation of the program for the Department
4. BOCES - Primary responsibility for providing the assistance to school districts which will allow them to meet the objectives of the program

5. School Districts - Each district will be responsible for developing its own management plan using the state program as a guide

6. Schools - Responsible for the development of their own program as it pertains to the district's plan and goals

B. Staff Structure

1. State Elementary and Secondary School Energy Coordinator

Will act as the administrator in charge of the program for the state and will:

a) Act as liaison between the state and regional agencies, and the school districts

b) Assist the Regional Coordinators in achieving their program goals

c) Collect the data required to measure progress in the achievement of the program's goals

d) Develop qualifications of energy auditors

2. Regional Energy Coordinators

The number of Regional Coordinators will depend upon how many BOCES wish to combine forces. Some of the regions are too small to support a full time position, and may wish to establish part time positions. Some regions may wish to combine with others.

To test the feasibility of combining regions, EFL prepared a theoretical model which combined two or more adjacent regions into a plan with 21 super regions. No region contained more than three of the present regions, and six remained intact. The average number

of schools per region was 160. EFL is not suggesting that this particular combination be adopted. The possibility that the smaller regions could combine their energy activities should, however, receive serious consideration. The New York State BOCES regions are shown on the map on the following page.

EFL recommends that the position of Regional Energy Coordinator be a full time responsibility, and be continued for at least three years. Whether the position should remain full time for the entire three years, will depend somewhat on the success of the coordinator in implementing the program in his districts.

The primary responsibilities of the Regional Coordinators are to:

a) Carry out the policies and programs specified in the State regional and local plans

b) Be responsible for establishing training and workshop programs for the region

c) Assist districts in conducting energy audits

d) Assist districts with application for State and Federal Grants

e) Assist districts in identifying and securing expert outside consultants

f) Compile regional energy data and coordinate the energy management efforts of the districts in his region

g) Publicize achievements by districts in his region

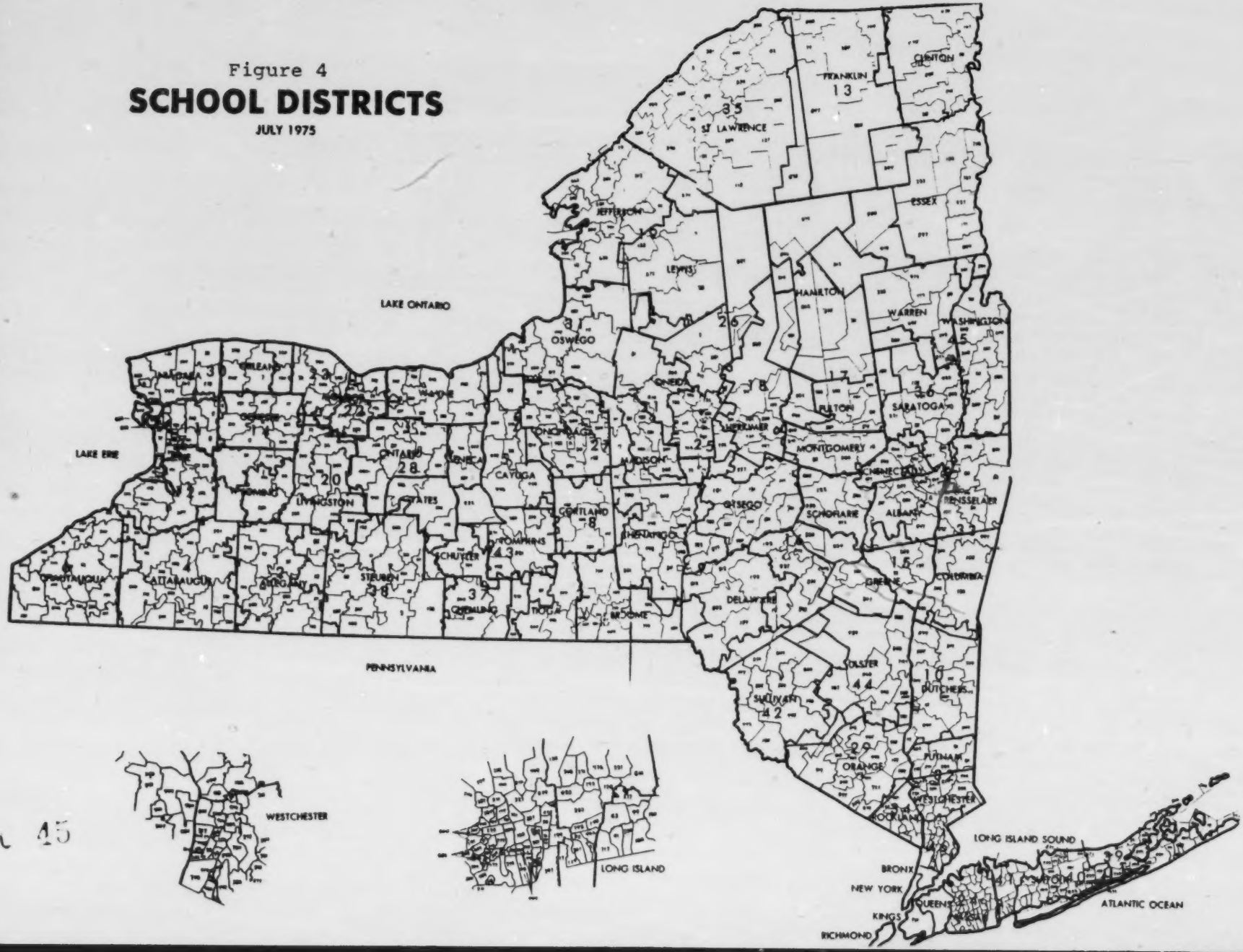
3. District Energy Managers

Will have administrative responsibility for implementation of the district's energy program. Will work closely with the Building Energy Managers and the Regional Coordinator

Figure 4

SCHOOL DISTRICTS

JULY 1975



4. Building Energy Manager

Will have primary responsibility for energy management and related energy programs at the building level

C. Committee Structure

The committee structure is designed to parallel the staff structure at each of the four levels; state, regional, district and school. Its function is to provide broad based support for the energy programs, and to provide guidance and direction to the staff responsible for carrying out the day to day activities of the energy program.

1. State Elementary and Secondary Energy Advisory Committee

Advise and consent on State programs, review progress toward state goals, and suggest program additions and modifications

a) Suggested membership - representatives from:

(1) City
(2) Village
(3) District
(4) Regional Superintendents
(5) District Energy Manager
(6) School Energy Manager
(7) New York State Energy Office
(8) New York State Education Department
(9) Architects
(10) Engineers

2. Regional Energy Committee

This committee is made up of representatives from the districts in the region, and shall have responsibility for the formulation of policies and programs that will fulfill the requirements of the state and district energy programs

a) Suggested membership - representatives from:

(1) Regional Superintendent
(2) City, Village and District Superintendents
(3) BOCES Board member
(4) Parents
(5) Students
(6) Teachers
(7) District Energy Managers
(8) School Energy Managers

3. District Energy Committee

Responsible for developing and implementing an energy plan unique to the district which will be consistent with the goals of the state program

a) Suggested membership - representatives from:

(1) Board of Education
(2) Central Administration
(3) Teachers
(4) Students
(5) Parents
(6) Maintenance and operations

4. School Energy Committee

Responsible for carrying out the district's energy plan, developing programs, collecting and monitoring data pertaining to their school

a) Suggested membership - representatives from:

(1) Principal
(2) Teachers
(3) Custodian
(4) Parents
(5) Students

5. Audit Teams

Responsible for assisting the school energy committees with energy audits

a) Suggested membership - representatives from:

(1) District Energy Manager
(2) District maintenance personnel
(3) School Energy Manager
(4) Consultants
(5) Utility Representatives

D. Technical and Educational Advisory Structure

A wide spectrum of organizations and individuals must be available to the professional staff to assist the Regional Coordinators in providing services to the districts. Included in this category are the following:

1. Professional Consultants

As the program develops, there will be a need to engage various consultants and advisors to assist in training the Regional Coordinators, making detailed energy audits and preparing plans for retrofit programs. The State and Regional Coordinators should be able to identify persons and firms qualified to perform various energy services

2. Educational Consultants

The Regional Coordinators and the State Coordinator may wish to call upon one or more experts from the college and university field to assist in developing courses and workshops

3. Data Processing Centers

The program calls for processing PSECS yearly audits through two Lead BOCES Data Processing Centers

EFL has been working with ERIE 1. BOCES and Nassau BOCES. Both have the technical capability to handle this activity, and are well located to cover the state.

Processing of the monthly program should be handled by the Regional Data Centers. Data processing for the large cities should be handled either through their own data center or by agreement with a Regional Data Center.

It will be the joint responsibility of the State and Regional Coordinators, to develop an inventory of the individuals and organizations who have proven skills in the various areas of energy management pertinent to the requirements of the program.

CHAPTER V

SUGGESTED ACTIVITIES AND ORGANIZATIONAL STRATEGIES

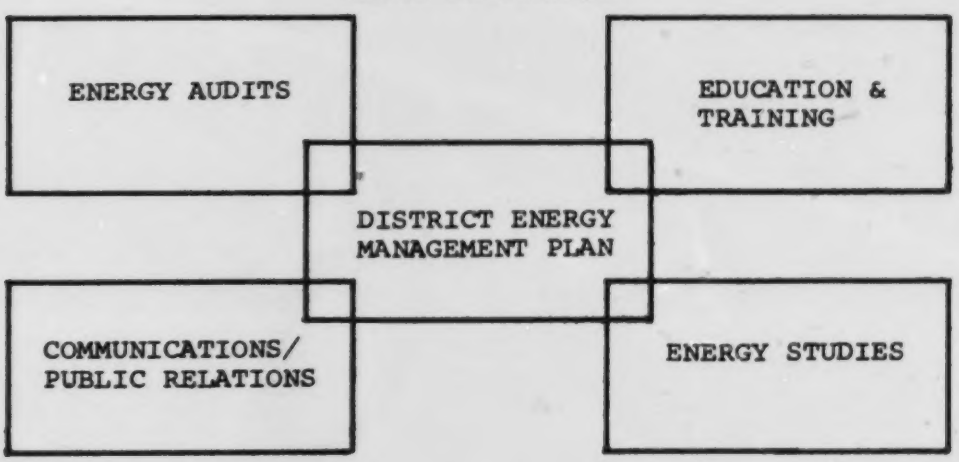
5.01 SCOPE

Successful energy management requires organization, commitment, and implementation of activities designed to meet the program's goals and objectives. In selecting activities, consideration must be given to the capabilities of those who will be responsible for, and involved in the various facets of the program. The activities suggested for inclusion in this program may be grouped into four broad categories: (1) energy audits (2) education and training (3) communications/public relations, and (4) energy studies.

These activities are designed to assist the school districts in the development and implementation of their energy management plans. The state and the regional organization will be responsible for providing assistance to the district in each of the four categories of service:

FIGURE 5

MAJOR ACTIVITIES



5.02 ENERGY AUDITS

The term energy audit as used in this program, covers a wide range of activities which are designed to discover how, where, and for what purpose, various forms of energy are being used in a building. Audits vary in their completeness from a simple walk through by an energy expert, to an in depth study by professional engineers that provides estimates of costs and savings which could result from specific and detailed changes in the building's operation and equipment.

The audits contemplated for use in this program may be divided into three types: (1) preliminary (2) monthly and (3) maxi.

The audit procedures outlined below are designed for application to school buildings and may not be appropriate for some auxiliary or special use facilities. Vocational-technical schools usually fall into this category. Additional research studies may be required to develop appropriate audit procedures for these facilities. Provisions for such studies are included as part of the management program and are discussed in more detail in section 5.05.

The preliminary audit is designed to provide the information necessary to develop an energy management plan for each school. The culmination of the preliminary energy audit should be the implementation of this plan.

A. Preliminary Energy Audits

A preliminary audit is to be conducted for all elementary and secondary schools and education related facilities. Sixty percent of the elementary and secondary schools should have their preliminary audits completed by the end of the first year of the program. The remainder

would be completed in the second year. The following procedures have proven to be effective and are recommended for use by the school districts:

1. Form Audit Teams - District

   The number, composition and size of the team will depend upon the size of the district, the type of facility to be audited and the personnel available. The team will usually be headed by the district energy manager and needs at least one technically qualified member who may be an architectural or engineering consultant, staff engineer, maintenance director or utility company representative.

   The district team will be supplemented by members of the energy committee from the school being audited. The school energy manager is the person responsible for the audit of his school. He may also serve on the district team to assist with the audits of other schools. At least one member of the team, preferably the team leader, should have completed training in the conducting of preliminary audits.

2. Train Audit Teams - Region

   Each region will be responsible for providing training for district auditors. (See section 5.03 A. 5 on page 38 for a description of this workshop.)

3. Collect Building Data - School

   This will be the responsilility of the school energy manager. He will be assisted by the district audit team as required. The data should be collected using the PSECS data collection froms PS41 and/or PS42, which provides a uniform procedure for the development of the district's data base.

4. Compile School Data - District

   The district energy manager collects the data from each school, reviews the information and sends it to the regional coordinator for processing.

5. Data Processing - Lead Data Centers

   The regional coordinator is responsible for this activity. He has access to a data center where processing, using the PSECS Guideline Analysis computer program, will be accomplished. Following processing the audit data is returned to the district.

6. Form Data Base - District

   The information becomes part of the district's data base. Individual school data is returned to the school energy manager.

7. Self Audit/Mini Audit - School

   This is the responsibility of the school energy manager. He will be assisted by the district audit team and additional consultants. The GAP4 self audit materials are used as a part of this audit.

8. Develop School Energy Management Plan - School

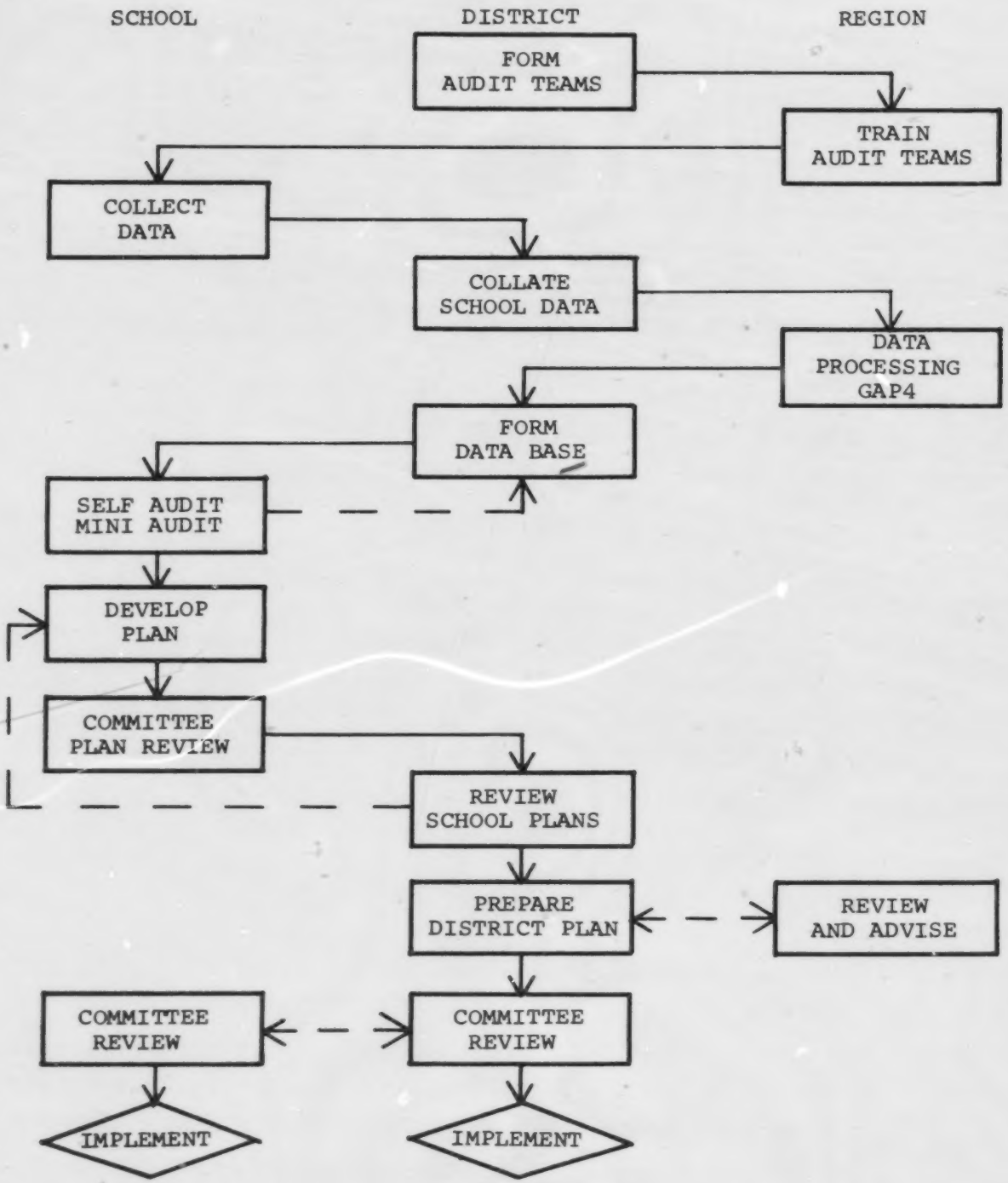
   The results of the audit are used to develop this plan which is reviewed by the school energy committee and submitted to the district for inclusion in the district plan.

9. Implement Energy Management Plan - School

   While the procedures described above make extensive use of PSECS materials, other audit procedures can be substituted at the option of the district. The preliminary audit process is diagramed on the following page.

FIGURE 6

TYPICAL PRELIMINARY AUDIT PROCEDURE



B. Monthly Monitoring

Two types of monthly monitoring are proposed for use in this program: (1) A manual record keeping system whereby energy use is charted on a monthly basis and comparisons are drawn with the same month of the previous year. This may involve various methods of reporting, such as MBTU/SQ FT or BTU/degree day, etc. This is a minimum level program for all schools. (2) Monthly goal analysis program uses the Monthly Comparison Report (MCR1) computer program to generate a monthly energy use guideline. The MCR program makes use of factors generated by the GAP4, and additional input factors involving daily weather, a district calendar, and monthly energy use information in order to provide a comparison of actual and guideline energy use on a monthly basis. By the use of monthly monitoring, the effects of operational or physical modifications can quickly be assessed, and problems can be corrected in a more timely fashion. The reporting process also serves as a continuous reminder to district and school energy managers of the need for constant vigilance, by providing indications of any slippage in conservation efforts. The principal activities required in the MCR program are:

1. Completion of a preliminary audit using GAP4.
2. Collection of daily weather information. This information should be collected by each region or district depending upon the variation in weather within the region. This activity may also be used as a part of the energy activities of the students.
3. Collection of monthly energy use data.
4. Analysis of each school by the MCR program.
5. Review of the results of computer analysis and formulation of new courses of action.

The monthly monitoring program is designed to be used after a school has begun implementation of its energy management plan. Its purpose is to provide the energy manager with a means for checking progress toward the goals of the plan, and to facilitate the manager's prompt implementation of corrective action. Only a limited number of schools are expected to use the Monthly Comparison Report procedures in the first year, as energy management plans will be in the early development stages. As the plans are implemented during the second and third years, monthly monitoring will become an important part of the energy management program. (For a more complete explanation of the development and use of the MCR program, see Appendix B)

C. Maxi Audits

The most comprehensive examination of the energy use patterns in a school building, as well as the most time consuming and expensive, is the Maxi Audit. The information gathered in the preliminary audits, and the correction of deficient operational and maintenance conditions revealed by the audits, are prerequisites for the undertaking of the Maxi Audit.

The scope of the audit is usually determined by the school district, and must be fully delineated at the contract stage. Such audits are usually undertaken by professional consultants who conduct a thorough on site investigation of the physical plant, its operating systems, use patterns and historic energy consumption. The audit may, or may not involve a computer analysis.

Consultant costs can range from one thousand to ten thousand dollars, or more, depending on the service desired. The process is essential in determining the cost effectiveness of various proposed modifications.

Responsibility for consultant selection rests with each district. Regional Coordinators will assist the districts by providing model consulting contracts, identifying qualified professionals, and by reviewing consultant recommendations.

A maxi-audit will be required for participation in Capital Grant programs at both the state and federal levels

5.03 EDUCATION AND TRAINING ACTIVITIES

The success or failure of energy management is dependent in large measure on the skills and abilities of the energy managers. Very few of the individuals who will operate in that capacity have received formal training in energy management. Many of the activities proposed for use in this plan will require special training. This training must be provided as a part of the energy management program.

A workshop program is proposed as the principal means of developing the energy management skill of those who will be directly involved in carrying out the school and district energy management plans.

Special courses and degree programs designed to raise the general skill level of management personnel, are outside the present scope of this plan.

Workshops, when skillfully conducted, have a proven record of success. (See Appendix C for an example of a successful Workshop program.)

A. Phase One Workshops - State and Regional Personnel

As a part of the start up procedures it will be necessary to instruct state and regional personnel in various aspects of the state program. The following workshops are proposed for Phase One:

Workshop Number 1 - Introduction to the State Energy Management Plan

Participants: Regional Energy Coordinators and State Energy Staff
Purpose: To explain the state program, establish lines of communication, provide instruction in the various audit procedures and in data gathering. Coordinators who complete these courses will be qualified as energy auditors/instructors.
Instruction Staff: State Energy Coordinator and EFL

Workshop Number 2 - Data Processing for GAP4

Participants: Lead Data Center personnel
Purpose: Provide training in the operation of GAP4 computer programs
Instructors: EFL

Workshop Number 3 - Data Processing for MCR1

Participants: Regional Data Processing Center personnel
Purpose: Provide training in the operation of the Monthly Comparison Report
Instructors: EFL

B. Phase Two Workshops - Regional and District Personnel

Primary responsibility for the Phase Two Workshops has been placed with the regional energy coordinators. They will be assisted by the state energy coordinator's office which will identify individuals and organizations possessing the skills required to conduct a wide variety of workshops.

A partial list of topics for these regional workshops is included below. The number of workshops and the topics

covered will vary from region to region depending on the need of each district.

Workshops four and five are integral to the start up activities and must be completed prior to the start of the special workshop activities. The following workshops are proposed for Phase Two:

Workshop Number 4 - Introduction to the State Energy Management Plan

Participants: Regional and District Energy Committee representatives, District and School Energy Managers and Superintendents

Purpose: To explain the state plan, establish lines of communication, and lay the ground work for the development of regional and district plans

Instructors: Regional Energy Coordinator

Workshop Number 5 - Introduction to Preliminary Audits

Participants: District Audit Teams

Purpose: Instruction in data gathering audit procedures and plan refinement

Instructor: Regional Energy Coordinator

Workshop Number 6,7,8, etc. - Special Regional Workshops

Participants: District and School Energy Manager, building operators, maintenance personnel
The workshops to be scheduled as the need arises
Suggested topics:

-boiler operation controls
-efficiency testing
-infra red thermography
-purchasing professional services

-lighting
-operation and maintenance
-record keeping
-use of the building as a learning laboratory for students
-assistance in developing course outlines (selection of instructors will be provided by the State Energy Coordinator)

Additional workshops should be added as specific needs are recognized. Regional Coordinators working with the districts are in the best position to recognize these needs and to organize programs to meet them.

5.04 COMMUNICATIONS/PUBLIC INFORMATION

The Energy Management program seeks to involve a wide spectrum of individuals, both in and out of the educational community. While such involvement should facilitate the flow of information about energy activities, a more formal publicity program should be organized at each level.

The Energy Management Program's activities and achievements must be promoted to the general public in order to elicit their support and focus local, regional and national attention on the Program's progress. Its importance must be stressed to the public, to school students, administrators, teachers, board members, and parents. Dissemination of information can be achieved through press releases, newsletters, seminars, energy fairs, posters, contests, etc.

It is not the purpose of this report to detail a public relations program, but merely highlight its importance in securing the support of all members of the community for the conservation efforts of the school districts. Schools are the most visible public agency and therefore in the best position to educate the general public about energy conservation.

A Regional Energy Coordinator should maintain sufficient communication channels to be able to summarize the progress of the districts in his region toward the stated goals. The form and content of these reports should be worked out cooperatively between the state, regions and the districts.

5.05 ENERGY STUDIES

In the process of implementing the energy management activities, certain discrepancies in the available knowledge will be discovered. While not all of these problems will be appropriate subjects for research at the state level, there must be provisions in the state plan for research efforts. These efforts should be under the direction of the State Energy Coordinator who may seek assistance from other agencies, such as the New York State Research and Development Authority, The New York State Energy Office, County Energy Offices, U.S. Department of Energy, and/or the various universities, or he may in some instances, conduct minor research, using his own staff, or staff available to him. Such studies might include:

A. The cost of various retrofit measures undertaken by New York schools.

B. A method of evaluating the energy efficiency of school buildings prior to their construction.

C. The effect on energy consumption, of various capital improvements.

D. Energy analysis of special facilities, (administration buildings, and vocational/technical centers.)

5.06 ORGANIZING THE PROGRAM

While it is possible to suggest a starting point for key activities involving the state and region, the schedule for the individual

school districts can only be given in general terms.

The program cycle is expected to take three years to complete for districts which have not begun their planning.

The principal activities to be completed in each year are given below:

Year One

- Develop state and regional support structure
- Prepare district energy management plans
- Complete preliminary audits on 60 percent of the schools
- Establish district data bases
- Begin training activities

Year Two

- Implement operational changes recommended by preliminary audits
- Begin energy monitoring
- Complete all preliminary energy audits
- Conduct cost benefit analysis of potential capital modifications
- Determine costs avoided as a result of the Year Two program
- Evaluate and revise programs

Year Three

- Continue energy monitoring
- Continue audit program
- Continue capital improvement program
- Determine costs avoided as a result of Year Three programs
- Evaluate results of three year program

It is anticipated that the program will be submitted to the New York State Board of Regents for its review by October, 1978. The actual starting date for the program is dependent upon approval by the Regents, and securing the funds required to operate the program.

The program's activities may be divided into two parts: 1) Start up activities and 2) on going program activities.

A. Start Up Activities

Start up activities involve establishing state, regional and district organizational frameworks. It also involves recruiting and training the personnel who will provide support services to the school districts.

The principal start up activities are described on the following page. The relationship between the activities and an ideal time line for completion is illustrated on page 47.

Table 1

START UP ACTIVITY SCHEDULE

Responsibility	Activity #	Description	Days From Start
SED	0	Presentation of Plan to Regents	0
SED	1	Endorsement of State Energy Management Plan. (This assumes program has been reviewed by all interested parties.)	20
SED	2	Appoint State Energy Coordinator; (SEC) Set up Staff	20
SED BOCES/CITIES	3	Establish Regional Energy Assistance Centers (REAC)	50
REAC	4	Appoint Regional Energy Coordinators (REC)	50
SED/BOCES	5	Designate 2 Lead Data Centers	50
DISTRICTS	6	Develop District and School Energy Organization	70
REAC	7	Establish Regional Energy Committees	70
SED/EFL	8	Conduct Workshop #1 Introduction to State Energy Management Plan	70
EFL/LDC	9	Workshop #2 Data Processing for GAP 4	70
EFL/RDC	10	Workshop #3 Data Processing for MCR 1	90
REC	11	Workshop #4 Introduction to State Plan - District and Regional	90
REC	12	Workshop #5 Introduction to Preliminary Audits - District Audit Teams	90

The following abbreviations are used in the activity schedules:

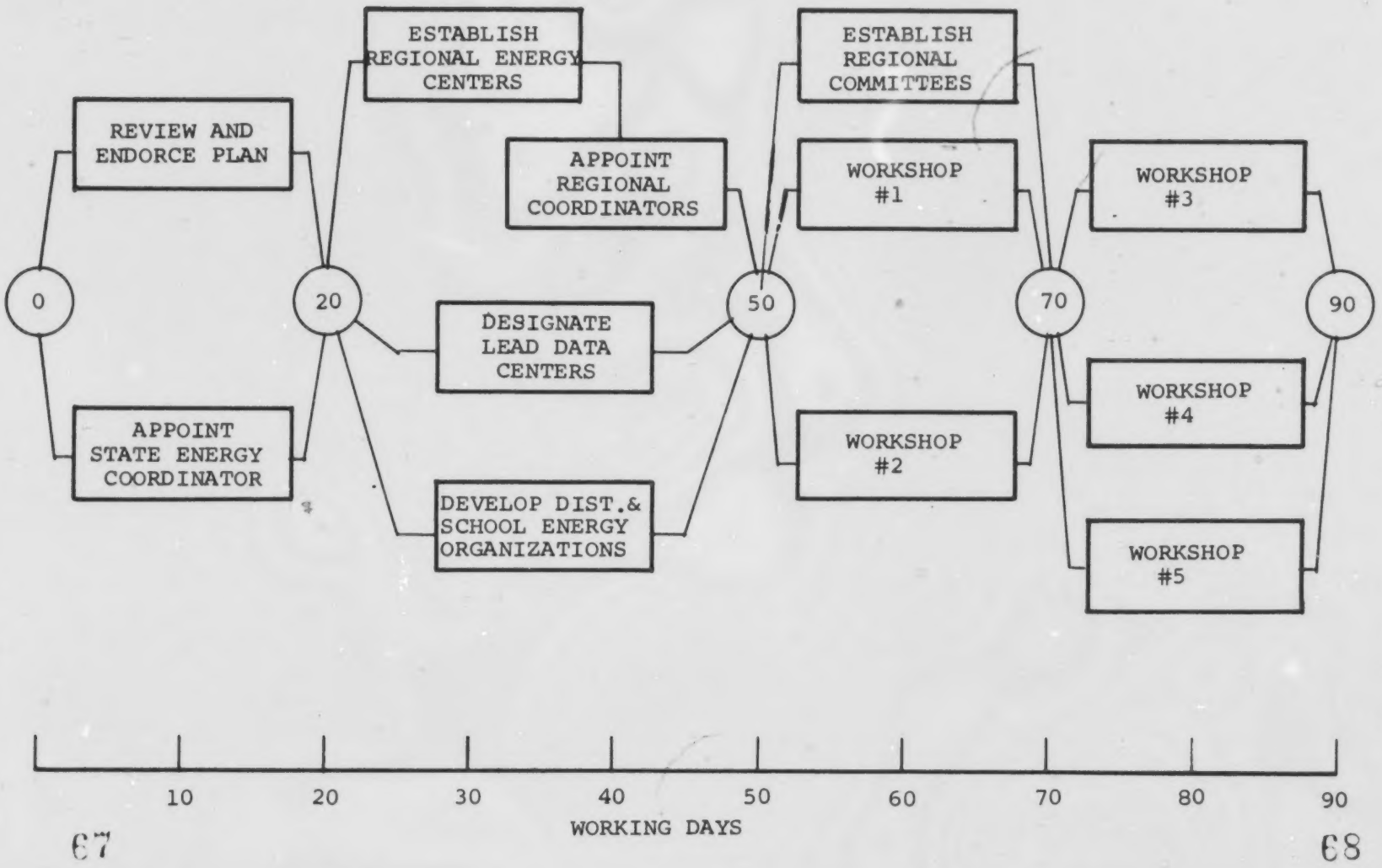
BOCES = Board of Cooperative Educational Services
EFL = Educational Facilities Laboratories, Inc.
LDC = Lead Data Centers (2)
RDC = Regional Data Center
REAC = Regional Energy Assistance Center (BOCES and Cities)
REC = Regional Energy Coordinator
SEC = State Energy Coordinator
SED = State Education Department

Following an ideal schedule, the start up activities should be completed in approximately ninety working days, or four one half months.

The relationships between the activities, along with the elapsed time schedule is shown on the following page.

FIGURE 7

ACTIVITY SCHEDULE - START UP PHASE



B. Ongoing Program Activities

Ongoing program activities are controlled by the individual districts which are responsible for developing their own plans, and putting them into operation. The goals, elements and activities developed in the state-wide plan should serve as a model for the development or revision of individual district plans.

Some New York districts have already developed and implemented energy plans, while others have not yet begun. It is anticipated that those that have developed plans will review them, and upgrade them as required.

Those districts that have not yet developed plans will use the state-wide plan as a model for their own districts.

Phase Two districts which have already implemented energy management plans, will undertake activities scheduled for years two or three, depending on their progress.

Most Phase One districts now developing their plans will concentrate on the first year's activities.

Schedules for the first year of operation for both Phase One and Phase Two districts are presented on the following pages.

Table 2

TYPICAL ACTIVITIES - PHASE ONE DISTRICT
YEAR ONE

Responsibility	Activity #	Description	Days From Start
DISTRICT	0	Complete Start Up Activities	90
DEM	13	Develop Initial Management Plan Based on State Model	110
AUDIT TEAM	14	Conduct Preliminary Audits - all Schools and District Facilities	160
SEM/DEM	15	Review Audit Recommendations, Develop School Plans	180
DEM	16	Review School Plans, Prepare Final District Energy Management Plan	200
DEM/SEM	17	Implement Plan	200
SEC/REC	18	Personnel Training Workshop #6,7, 8, etc.	200
DEM/REC	19	Monitor results of Operational Changes	200
DISTRICT	20	Review Results of Year One Program	260
DEM	21	Prepare Revised Plan Year Two	260

DEM = District Energy Manager
REC = Regional Energy Coordinator
SEC = State Energy Coordinator
SEM = School Energy Manager

Table 3

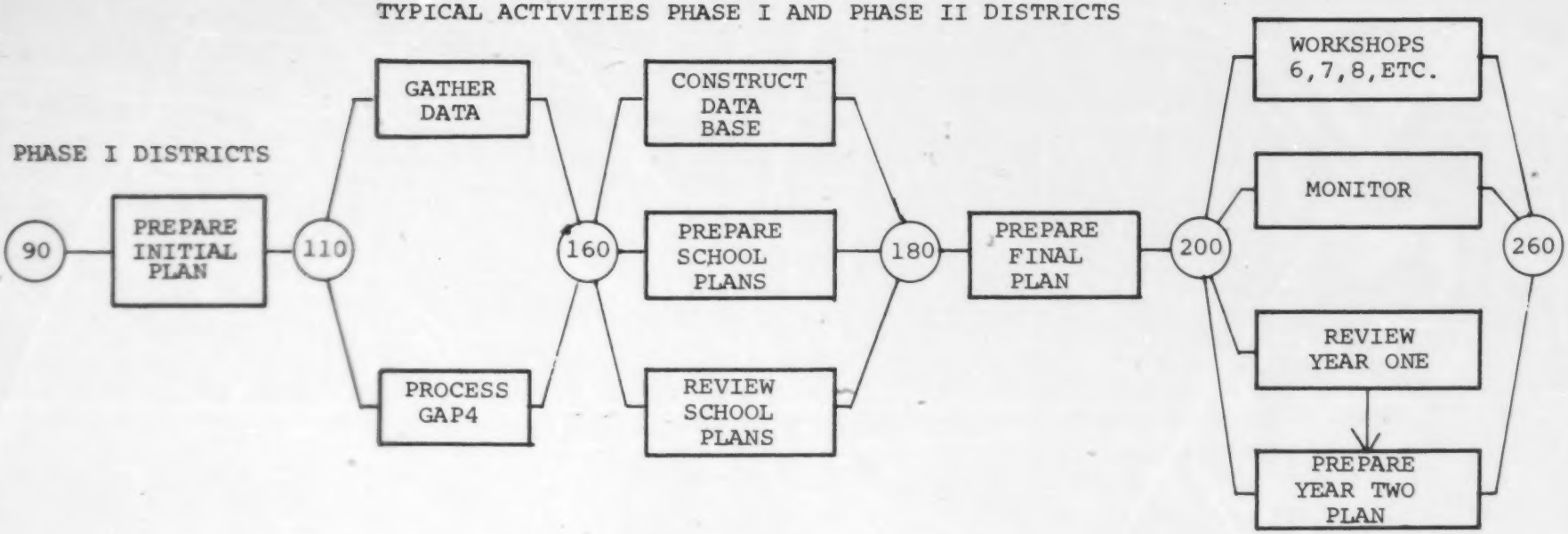
TYPICAL ACTIVITIES PHASE TWO DISTRICT
YEAR ONE

Responsibility	Activity #	Description	Days From Start
DISTRICT	0	Complete Start Up Activities	90
DEM/SEM	22	Upgrade Previous Audits	110
SEM/DEM	23	Review Audit Recommendations, Prepare Revised School Plans	120
DEM	24	Review School Plans and Prepare Revised Management Plan	140
DEM/SEM	25	Implement Plan	140
SEC/REC	26	Personnel Training - Workshop #6, 7,8,9, etc.	140
CONSULTANTS/DEM	27	Conduct Maxi Audits as Required	140
DISTRICT	28	Implement Construction/Modifications	140
DEM/REC	29	Monitor Results of Modifications, Operational and/or Capital	140
DISTRICT	30	Review Results of Year One Program	260
DEM	31	Prepare Year Two Plan	260

DEM = District Energy Manager
REC = Regional Energy Coordinator
SEC = State Energy Coordinator
SEM = School Energy Manager

FIGURE 8

TYPICAL ACTIVITIES PHASE I AND PHASE II DISTRICTS



○ = Elapsed time in working days since start of program

Many districts will be unable to develop or implement energy management plans without the help and encouragement of the support system recommended by the model program. Regional energy centers must provide this support, with backing from the state. The progress of each district must be monitored by the regional coordinator who will then make this information available to the districts in his region, and to the state. The state energy coordinator will review all regional reports, and supply pertinent energy information to all the districts in the state.

CHAPTER VI

INCENTIVE CONSIDERATIONS

6.01 SCOPE

Incentive programs may be divided into two classes: (1) those designed to encourage districts to participate in energy management programs, and (2) programs instituted by districts to encourage active participation in a district program.

A. Programs Designed to Encourage District Participation

Incentives may be positive or negative. No state programs using a negative incentive approach were encountered in EFL's survey. In some instances, participation was "strongly encouraged" with the implication that if such suggestion went unheeded, additional measures might be needed.

The overriding incentive for most school districts is financial. This may take several forms including:

1. Federal Grants - The proposed Schools and Hospitals Grants Program has provided a stimulus to many districts to undertake energy audits in anticipation of receiving funds under this program. There is no certainty that this particular legislation will be approved. The fact that so many districts have been stimulated to take action before the bill becomes law, is a good indication of the power of financial incentives.

   The Federal Government is presently providing funds to the New York State Energy Office for various conservation programs.

The possibility exists that a portion of these funds could be utilized to assist school districts in their energy conservation programs.

2. State Assistance - In addition to the assistance cited above, states have provided encouragement through workshops, technical assistance programs, and financial grants for retrofit programs. While money seems to provide the greater stimulation, various non monetary assistance programs have been very successful. North Carolina provides school districts with a walk through audit conducted by state engineering personnel, and a monthly report of their energy use. While participation is voluntary, the district signs an agreement to comply with the steps necessary to operate the plan.

   Most districts need support services to carry out their plans. The availability of someone to call upon for assistance is a great incentive for school districts with limited expertise in energy management.

B. District Incentive Programs

Incentive plans within districts have used two principal means of encouraging participation in energy conservation: (1) money and (2) recognition.

To encourage saving in energy, a number of districts set up a plan whereby schools which reduced their energy use over some base year, (usually the past year) shared in the savings. This worked so long as prices were fairly stable, but often there were no dollar savings due to increased energy costs per unit. There are several unresolved problems with programs of this type:

1. The use of base year figures often works against schools which have been operating efficiently. The efficient operator will find it difficult to achieve any major reduction in energy use, while schools that have been operated inefficiently can save 30 or 40 percent with minimum effort.

2. Adjustments must be made for difference in climate between the years being compared

3. School populations may differ from year to year, which can effect consumption

4. School programs may vary, so the use patterns, such as night use are not the same from year to year

Very few of the programs EFL examined took any of these factors into consideration. The occupants can, and do, have some control over how energy is used in a school. This control is minimal, however, confined primarily to the use of electricity.

The building operator is the real key to conservation. The daily operation of the energy consuming devices are a direct factor on the achievement of the building's energy goals. In most school districts, building operators never see the utility bills, nor do they receive comparative data to allow them to judge their performance with respect to the management of energy. Therefore, the building operator never shares in the reward or recognition of his efforts.

A more sophisticated reward system is the practice of decentralized budgeting. This process is applied to all costs associated with the operation of an individual school.

Using this system, each school principal is allocated a total amount with which to operate his school. The more he spends on such non-instructional items such as utilities, the less there is for instruction. The practice of budgeting utilities where fuel is used, tends to increase the concern of those who have control over their use.

Although monetary rewards are often effective in the short term, long term efficiency can only be sustained through the efforts of dedicated and skilled energy managers. Conscientious effort should bring recognition to both the individuals and the institution responsible for outstanding efforts in energy management. The public recognition of such efforts by the school board and top level administration through the granting of energy efficiency awards, will have the added effect of dramatizing the support of top level authority for the program.

6.02 PROPOSED INCENTIVE PLAN

The incentive program proposed for use in this plan includes the following:

A. Financial Assistance

The state should share in the cost of conducting the preliminary audits. This may be accomplished by:

1. Paying for the data processing required in the various preliminary audit procedures
2. Sharing in the cost of technical assistance through the Regional Coordinators
3. Sharing in the cost of workshop instructors

B. Technical Assistance

The Regional Assistance Centers staffed by a Regional Coordinator, are set up to provide this service to the districts.

C. Public Relationship Materials

The Regional Centers, and The State Energy Coordinator should provide the districts with materials that will assist them in keeping their constituents informed on the success of the program.

CHAPTER VII

PROGRAM COST ESTIMATES

7.01 SCOPE

The proposed energy management program will involve personnel from the state, the regions, and the districts. No attempt has been made to estimate the additional personnel costs at the district level. Some districts may wish to create the position of energy manager, while others will add this responsibility to an existing position.

The additional staff requirements at the state and regional levels have been kept at a minimum. The number of regional coordinators required is dependent upon the number of BOCES which combine to service two or more districts. For budgeting purposes a figure of 33 Regional Energy Assistance Centers has been estimated. When an exact number has been determined, the budget can be adjusted.

7.02 COST ESTIMATE - YEAR ONE

The first year of the program is devoted largely to organization, training, plan development and energy audits.

The principal costs in addition to personnel, are for start up workshops and the preliminary audit program. The first year's cost is estimated at $2,418,500, including staffing for 33 Regional Energy Assistance Centers.

The Year One budget estimate is shown on the following page.

Table 4

COST ESTIMATE - YEAR ONE

ENERGY MANAGEMENT ASSISTANCE PROGRAM

State Personnel		Number	Rate	Total
State Energy Coordinator		1	$30,000	$ 30,000
Energy Engineer		1	22,000	22,000
Support Staff		1	6,000	6,000
Regional Personnel				
Regional Coordinators		33	$20,000	$660,000
Regional Support Staff		33	5,000	165,000
Energy Audits				
Preliminary:	Elementary	1,700	$ 400	$680,000
	Secondary	960	620	595,200
Monthly:	Elementary	1,400	20	28,000
	Secondary	800	30	24,000
Workshops				
#1 Regional Coordinator		1	$ 3,000	$ 3,000
#2 Lead Data Centers (2)		1	2,500	2,500
#3 Regional Data Centers		1	3,500	3,500
#4 Regional Workshop		33	750	24,750
#5 Audit Teams		33	750	24,750
#6,7,8, etc Regional Workshops		200	750	150,000
TOTAL ESTIMATED COST				$2,418,500
TOTAL COST AVOIDANCE (operations)				$8,713,000

A. Detailed Cost Breakdowns

The following costs were used in developing the unit cost for preliminary audits:

1. Preliminary Audits Cost Estimates

		Funded By
a) Elementary Schools:		
Data collection 2 man days @ $60/day	$120	District
Checking and adding weather data	10	Region
Self and Mini Audits 4 man days @ $60	240	District
Data processing	30	State
TOTAL	$400	
b) Secondary Schools:		
Data collection 3 man days @ $60	$180	District
Checking and adding weather, etc.	20	Region
Self and Mini Audits 5 man days @ $60	300	District
Coordinator assistance and review	70	Region
Data processing	50	State
TOTAL	$620	

2. Monthly Monitoring Cost Estimate

a) Elementary Schools:		
Data collection	$ 5	District
Processing and review	15	State
TOTAL	$ 20	
b) Secondary Schools:		
Data collection	$ 15	District
Processing and review	15	State
	$ 30	

B. Estimated Cost Avoidance - Year One

Since year one is devoted primarily to organization and program development activities, the number of districts which have fully implemented their programs will not be as large as in subsequent years. The costs avoided through improved operations is therefore applied to approximately one half of the schools that can be expected to complete their preliminary audits and institute operational changes during year one.

While many of the operational modifications are no cost items, the typical elementary school can expect to spend up to $1,200 for minor modifications, while a high school can expect to spend $2,500.

EFL's Phase I study projected a possible savings of $4,900 per elementary school and $14,100 per secondary school through changes in operation.

The year one cost avoidance due to operational changes may be computed as follows:

1. Year One Cost Avoidance

850 elementary schools @ $4,900	$4,165,000
480 secondary schools @ $14,100	6,768,000
Total Cost Avoidance	$10,933,000

2. Operational Modifications Cost

850 elementary schools @ $1,200	$1,020,000
480 secondary schools @ $2,500	1,200,000
Total Modifications Cost	($2,220,000)

3. Possible Cost Avoidance - Year One $8,713,000

Additional savings will be realized by districts that institute capital improvement for energy conservation, however, most of these savings will be realized in the second year of the program.

7.03 COST ESTIMATES - YEAR TWO

By the beginning of year two, the majority of school districts should have completed preliminary audits and instituted steps to bring their schools within guideline levels. Support personnel costs will remain about the same. Districts will incur additional consultant costs as they begin maxi audits

and construction. More savings will be realized as building efficiency is improved in newly constructed buildings.

A. Program Cost Estimate - Year Two

State Personnel		Number	Rate	Total
State Energy Coordinator		1	$30,000	$ 30,000
Energy Engineer		1	22,000	22,000
Support Staff		1	6,000	6,000
Regional Personnel				
Regional Coordinators		33	$20,000	$660,000
Regional Support Staff		33	5,000	165,000
Energy Audits				
Preliminary:	Elementary	1,400	$ 400	$560,000
	Secondary	300	620	186,000
Monthly:	Elementary	2,500	20	50,000
	Secondary	1,000	30	30,000
Workshops				
Regional		200	$ 750	$150,000
Total Program Cost				$1,859,000
Total Cost Avoidance (operations)				$12,510,000

B. Estimated Cost Avoidance - Year Two

At the beginning of year two, sixty percent of the buildings will have been audited and will have instituted energy management procedures. During year two, the remaining buildings will be audited, and districts will begin building modifications requiring capital expenditures. The majority of the savings will still be obtained through improved operations.

1. Operations Cost Avoidance

1,500 elementary schools @ $4,900	$7,350,000
600 secondary schools @ $14,100	8,460,000
Total	$15,810,000

2. Operational Modifications Cost

1,500 elementary schools @ $1,200	$1,800,000
600 secondary schools @ $2,500	1,500,000
Total	($3,300,000)

3. Possible Cost Avoidance $12,510,000

7.04 COST ESTIMATES - YEAR THREE

By the start of year three, all school districts should be operating within their guideline levels. Some slippage in effort will take place, and school audits must be upgraded and plans revised. The cost of upgrading preliminary audits is slight, compared with the cost of the initial audit, since most of the basic data has already been compiled. More districts will be making capital improvements for increased energy efficiency. Additional workshops will be required to insure that building operators are maintaining a high level of efficiency.

A. Program Cost Estimate - Year Three

State Personnel		Number	Rate	Total
State Energy Coordinator		1	$30,000	$30,000
Energy Engineer		1	22,000	22,000
Support Staff		1	6,000	6,000
Regional Personnel				
Energy Coordinator		33	$20,000	$660,000
Support Staff		33	5,000	165,000
Energy Audits				
Yearly Up Date:	Elementary	1,500	$ 90	$135,000
	Secondary	500	150	75,000
Monthly:	Elementary	2,500	20	$ 50,000
	Secondary	1,000	30	30,000
Workshops				
Regional		150	$ 750	$112,500
Total Program Cost				$1,285,500
Total Cost Avoidance				$21,395,000

B. Estimated Cost Avoidance - Year Three

At the end of year three the building should be operated at or near guideline. To be realistic, not all buildings will be operated efficiently. This is taken into consideration in estimating the savings over the base year for year three

1. Operational Cost Avoidance

2,300 elementary schools @ $4,900	$11,270,000
900 secondary schools @ $14,100	12,690,000
Total	$23,690,000

2. Operational Modifications Cost

1,200 elementary schools @ $1,200	$ 1,440,000
450 secondary school @ $2,500	1,125,000
Total	($ 2,565,000)

3. Possible Cost Avoidance $21,395,000

7.05 SUMMARY OF THREE YEAR PROGRAM COSTS

The program cost, exclusive of district personnel cost for the three year period, is $5,563,200. The estimated cost avoidance for the same period is $42,618,000 - a return on investment of more than 7 to 1.

A summary of the three year budget is shown below:

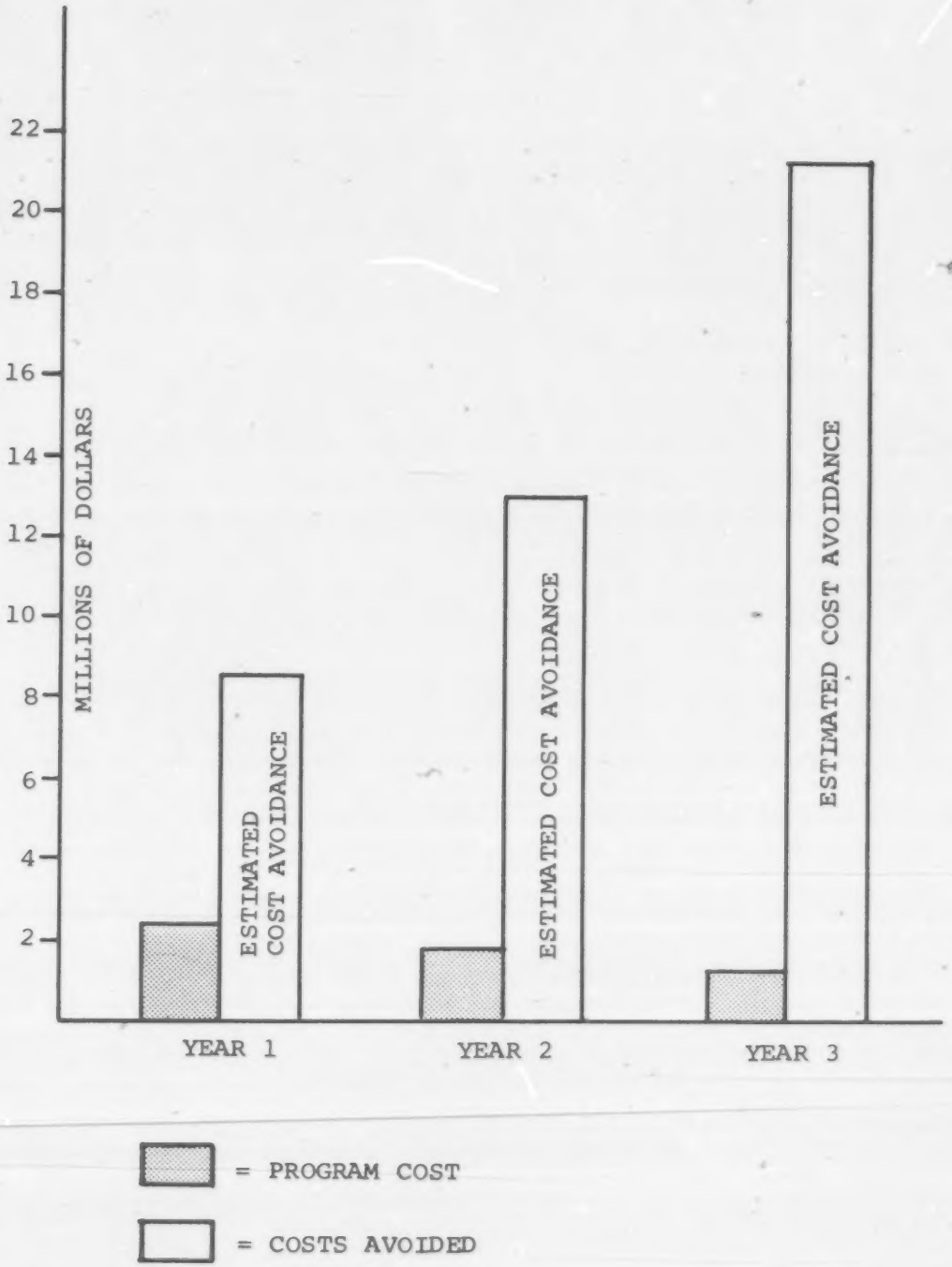
Table 5

BUDGET SUMMARY

	YEAR 1	2	3	TOTAL
State Personnel				
State Energy Coordinator	$30,000	$30,000	$30,000	$90,000
Energy Engineer	22,000	22,000	22,000	66,000
Support Staff	6,000	6,000	6,000	18,000
Regional Personnel				
Coordinator	$660,000	$660,000	$660,000	$1,980,000
Support Staff	165,000	165,000	165,000	495,000
Energy Audits				
Annual	$1,275,200	$746,000	$210,000	$2,231,200
Monthly	52,000	80,000	80,000	212,000
Workshops	$ 208,500	$150,000	$112,500	$ 471,000
Total Program Cost	$2,418,700	$1,859,000	$1,285,500	$5,563,200
Estimated Cost Avoidance (operations)	$8,713,000	$12,510,000	$21,395,000	$42,618,000

FIGURE 9

COST AVOIDANCE AS A FUNCTION OF INVESTMENT



APPENDIX A

A SURVEY OF PHASE I DISTRICTS

BACKGROUND

During the course of Phase I, 123 elementary schools and 46 secondary schools were analyzed using the Public Schools Energy Conservation Service (PSECS) computer program GAP2.

The results were reported to the participating districts by means of computer printouts, special written reports and oral presentations. EFL also experimented with a number of self-audit methods designed to assist district personnel in discovering and correcting energy problems. Three approaches were taken in administering "Self-Audit" programs:

1. Level 1, Mini Audit included a "walk through" of the schools by a team lead by EFL, plus district personnel, utility representatives, engineers and other experts.
2. Level 2, EFL led demonstration - EFL provided material, worksheets, and conducted a "walk through" audit at one school for the Superintendents of Buildings and Grounds from four districts.
3. Level 3 Do-It-Yourself - EFL provided written instructions and worksheets to the districts, which were then to conduct their own audits.

The most successful approach to audits proved to be Level 1. The presence of "outside experts", such as utilities personnel or the district's own engineer, were very helpful in impressing

upon local personnel the major corrective actions that could be taken in the operation of the plants.

Level 2 was less successful, because although those who participated in the demonstration/training sessions understood the method, they did not have the time or means to implement the procedures in each of their schools.

The same problems were encountered with the Level 3 program. Where used, it was found to be beneficial. There are problems in motiviation which limit the effectiveness of the approach.

The smaller districts are so limited in manpower, that without some assistance they are unable to undertake new programs, no matter how worthwhile they may be.

In addition to the operations audits, a Capital Modifications analysis was run on 112 elementary and 38 secondary schools. This required that the districts complete an additional questionnaire, in order to supply the information necessary for this analysis.

This two step method of data collection proved to be difficult for both the districts and the processor. The data collection procedure has now been revised. All data required for processing both the operations and Capital Audits is now collected on a single form. The program now provides both audits automatically for all schools processed.

SURVEY OF PHASE I DISTRICTS

In order to determine the school district's perceptions of the effectiveness of the materials, procedures and results achieved in Phase I, EFL conducted a survey of all 22 districts in Phase I. The results of this survey are summarized as follows:

Many boilers operated far in excess of the hours required to provide for the academic schedule. In order to assist the district in making comparisons between their reported operating conditions, and those used in determining their suggested guideline, a series of tables comparing reported and guideline conditions in hours of boiler operations, operating temperatures, lighting wattage and boiler efficiency were added to the PS-8 reports.

4. To Whom Did PSECS Reports Go?

   a) 33 per cent to the individual schools.

      Comment: This is disappointing, since individual school reports were provided for distribution to all schools.

   b) 33 per cent to Boards of Education.

      Comment: This indicates that not many Boards considered energy conservation really important or, that the district did not wish to indicate their performance.

   c) 45 per cent to District Superintendents

   d) 16 per cent to citizen advisory groups

   e) 5 per cent to consulting firms

      Comment: The distribution of the reports indicates that many districts do not have energy conservation committees that are representative of all segments of the school community.

5. Action Taken - 35 per cent of those receiving the reports took action. Their actions included: the development of an application for a Public Works Grant to implement Capital Modifications for energy conservation, refinement of the district's energy conservation plan, institution of monthly energy use recording, and several instances of equipment and boiler improvements.

1. 73 per cent of the participants felt that the program was timely, and considered energy conservation as a top priority.

2. Operation of PSECS

   a) Understanding the data forms - 5 per cent of those polled had difficulty understanding the forms. The most difficulty seemed to be with the secondary school forms, where instructions were found to be unclear, and terms confusing.

      Comment: While few respondents thought they had difficulty with the forms, the number of errors found by the EFL staff indicated that the actual percentage of those who did not understand was in fact much greater. Problems were most common in the description of mechanical systems.

   b) Collecting the Information - 35 per cent had difficulty collecting information, especially for secondary schools.

   c) Interpreting the Results - 25 per cent had difficulty interpreting the results of the printouts, and were unsure as to how to proceed in using the information.

   d) Response Time - No district expressed difficulty with EFL's response time in the course of this project.

   e) Other - 5 per cent felt that a lack of follow up to the report seriously affected the program.

3. Differences in Operating Efficiency - 20 per cent found major differences between their assessment of their operating efficiency, and that reported by EFL. The majority of these cases were attributed to "unrealistic", (i.e., low) PSECS guidelines.

   Some of the differences were traceable to incorrect data concerning mechanical systems or building operation. Still others, were traceable to "excessive" boiler operation.

6. Self Audits - 56 per cent of the districts performed self-audits. They were performed by CEATA workers, O&M staff, funded from the O&M budget, and by the EFL staff.

7. Operating Changes Instituted as a Result of the Reports - 56 per cent of the districts modified their building operating procedures, 39 per cent to PSECS guidelines. The remaining 17 per cent adjusted set-back temperatures and times, checked boiler efficiency, and reset and recalibrated all controls. Districts have documented savings of 30 per cent, 32 per cent and 12 per cent.

8. Personnel Training - 47 per cent of the districts claim to have training programs.

9. Capital Modifications - 36 per cent of the districts plan to institute capital modification programs for energy savings.

   - 14 per cent to be financed with Public Works Act funds
   - 42 per cent financed from budgeted line items
   - 44 per cent financed with bond issues

10. Energy Management Plans and Goals - 52 per cent of the districts have an energy conservation plan, with goals that vary from a 5 per cent reduction over the previous year to a 40 per cent reduction from 1972-73 levels.

11. Energy Conservation Education

    - 43 per cent of the districts teach energy conservation
    - 30 per cent of these at the secondary level

12. Future Conservation Plans

    - 13 per cent plan further O&M changes
    - 26 per cent plan capital modifications
    - 13 per cent plan staff training programs

APPENDIX B

MONTHLY ENERGY REPORTING

In the course of developing PSECS, and of providing this service to more than 400 U.S. school districts, EFL has become aware of a need for actual/guideline energy comparisons on a second level. The annual comparison provided initially by the GAP2 - CIP2 programs, and currently by the GAP4 program, is useful in identifying problem areas and corrective actions, and in assisting districts in developing energy conservation programs in both operations and maintenance and retrofit areas. Once these programs are undertaken, however, monitoring must be available on a much faster basis than the annual interval possible with the GAP programs.

A much better situation exists if the district undertaking an energy management plan can obtain feedback on the plan's effectiveness on a monthly basis. If an actual/guideline use comparison for each month is made available to the district on a timely basis, the district and the school can quickly assess the effects of behavior or physical modifications, and make necessary corrections. Such a report also provides a means of continously reminding the district and the school of the need for energy management, and gives a quick indication of slippage in the effort.

Accordingly, in the summer of 1977, EFL began to develop a computer program which would provide such a monthly comparison capability. This effort was undertaken jointly with the Pacific Gas and Electric Company of California, one of the nation's

largest utilities. Because of the importance EFL attaches to the monthly report scheme as part of the overall energy management effort, the application and preliminary testing of the system were proposed in the scope of work for Phase II of the NYS/ERDA state energy plan project.

The development and effective application of a monthly comparison system involve at least four major steps. These are:

1. Development of the computer program and its supporting documents and procedures.
2. Establishing the base data required for each district and school.
3. Creating and managing the flow of monthly reports to and from the participant districts.
4. Evaluating the results of the process.

The Monthly Comparison Report Program (MCR1)

The computer program proposed for use in the NYS/ERDA state energy plan for schools is an extensively modified and simplified version of a program developed by EFL and PG&E. This simplified program, known as the Monthly Comparison Report, Version 1, or MCR1, provides each school with a comparison of actual/guideline and historical energy use for the preceeding month. Guideline energy use is calculated by using:

- factors generated by the processing of each school through the GAP4 computer program
- scheduling information
- actual weather data for the month

Briefly, the operation of the MCR1 may be described as the updating of a base file by a single monthly input on each or any school contained in the file. The program also allows

schools or districts to be added to the base file at any time. The base file contains:

- 1 rate schedules
- 2 district general information
- 3 district yearly operating calendars
- 4 school general information
- 5 school guideline energy use factors
- 6 hours of operation for each school
- 7 thirteen month history of energy use at each school

Except for items (1) and (3), these items are provided to the MCR1 by a single run of the GAP4 program which produces the annual comparison reports PS-5 and PS-8. If historical information is available in appropriate form, item 7 can be entered separately. Otherwise the system will not provide historical comparison for the first 12 months processed.

To perform the monthly comparison analysis, a single entry for each school containing actual energy usage during the month is required. Weather information for the month must also be available. Only one school need be updated to operate the program.

Establishing Base Data for the Sample Districts

The major element in the base data file for each district is a set of energy use factors produced by the revised PSECS GAP4 program from the same input data which produces the annual energy comparisons and recommendations of reports PS-5 and PS-8. The base data file is completed by adding district calendars and school hours of operation schedules to these computer generated factors.

Sample districts for the testing of the MCR1 approach were selected from among those New York districts which had participated in Phase I of the NYS/ERDA EFL program. The method of selection is described elsewhere in this report.

The selection process produced five test districts:

- Bedford
- Brewster
- Hudson
- Niskayuna
- Schenectady

Because of revisions made to the GAP programs in order to generate the base factors, a new survey of schools in these districts using revised forms PS-4A and PS-20A was required. Revised forms were distributed to the five districts for their completion. In addition, data reported for each school was field checked by EFL staff to insure accuracy and appropriateness. Four of the test districts were able to return forms in time for field checking and processing by EFL. TABLE MCR1 shows the schools actually processed.

TABLE MCR - 1

FORMS VERIFIED

District	PS-4A	PS-20A
BEDFORD CENTRAL	5	2
BREWSTER CENTRAL	3	1
H. HUDSON CENTRAL	6	1
NISKAYUNA CENTRAL	7	3
	21	7

The required supplemental scheduling data was also obtained through interviews with district and school personnel, and from available district and school documents.

The Flow of Monthly Data

One of the critical problems in developing an MCR1 type service, is to determine the reporting interval. In the system proposed for New York State this interval is defined as the calendar month. Energy data for the calendar month is based upon readings made at each school by school staff on the last day of each month. This procedure was arrived at after studying a number of alternative methods of use measurement. Among the factors considered very important in selecting this method were:

- the lack of consistent meter reading by utilities
- the lack of any correspondence between the calendar and the dates of utility meter reading
- the lack of correspondence between dates of readings of different meters by utilities
- the large number of schools using oil (and coal) as fuel in New York State

Accordingly, EFL established a procedure for the test districts which involved reading all meters, dipsticking tanks, etc, on the last day of each month, (or nearest work day thereto), and reporting calendar month usage in each fuel category to EFL. The first such readings were taken on September 30, 1977, in three of the test districts. Thus, the first monthly energy use data collected was for October 1977.

Inability to return monthly reports to the districts led to a slow attrition of districts using these procedures. One of the five districts established at the beginning of the program that they would prefer to use utility billing data and that they would accept the inherent incompatibility with the MCR1 scheme. TABLE MCR II shows data received.

TABLE MCR - II

MONTHLY DATA RECEIVED

Through April 1978	1 District
Through February 1978	1 District
Through December 1978	2 Districts*
Through October 1978	1 District
TOTAL	5 Districts

*Includes some unusable data

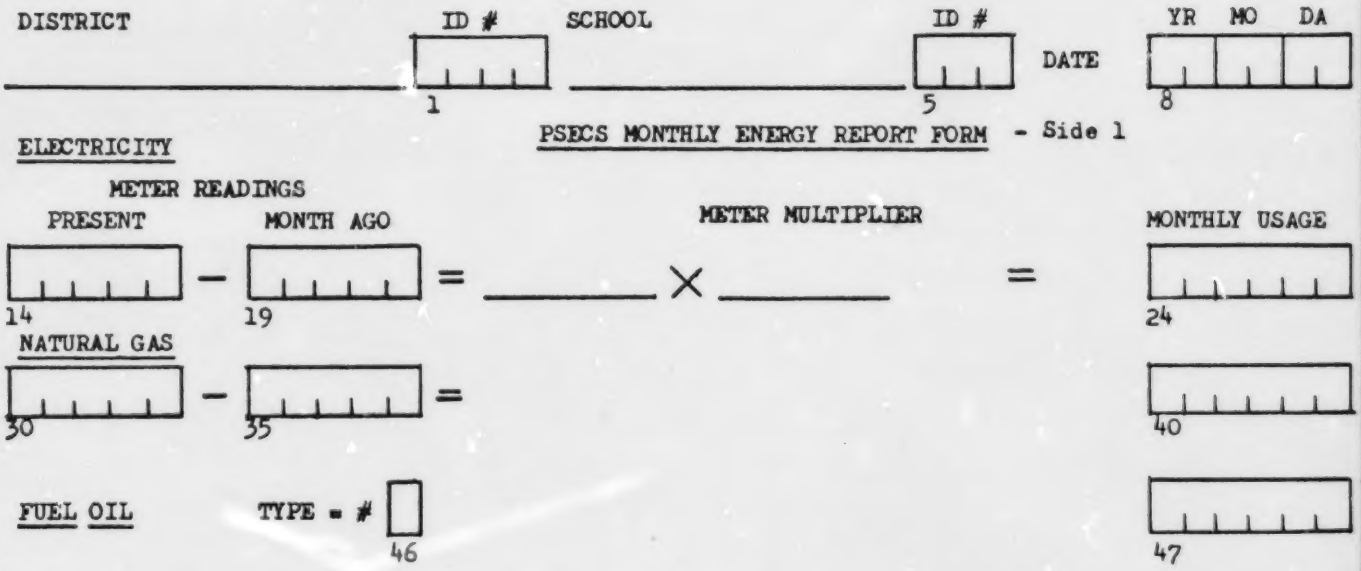
EFL had developed a mailer card on which each school could report its usage. These were distributed, but not used by the schools. Each district preferred to develop its own reporting system, with the district office as the key point in the process. This situation created problems in processing the data, and would not be practical in a large scale application.

Monthly weather data proved to be as great a problem as did getting energy information from the districts. There are many weather stations in New York State, so coverage was not a problem, in fact the project had an abundance of reporting locations. The problem is one of timing. U.S. weather service (NOAA) data is generally not available for at least 2 months after reporting. Private weather services make information available immediately at the end of the month, but these services are costly.

As a result, EFL used NOAA data, data from private weather services, and the district's own weather readings to process the schools. It should be noted that although a different weather station was used for each district in this program, there is no valid reason not to group districts by weather regions in a regular program.

Figure 10

PSECS MONTHLY ENERGY REPORT FORM



Side 2 - Schedule of Operation

ENTER INFORMATION ON THIS SIDE ONLY IF PATTERN OF USE DURING REPORTING MONTHS DIFFERS FROM NORMAL PATTERN.

Other information about operations which may affect energy use:

	REGULAR DAY		EVENINGS			SAT/SUN		
	Day/mo.	Hr./day	Day/mo.	Hr/day	PCT USED	Day/mo.	Hr./day	PCT USED
AUDITORIUM, THEATER	53	55	56	58		59	60	
GYMNASIUM	61	63	64	66		67	68	
ACADEMIC AREAS	69	71	72	74	75	76	77	78

PCT CODES:

None of space used.....0
1 to 25 per cent of area used.....1
26 to 50 per cent of area used.....2
51 to 75 per cent of area used.....3
76 to 100 per cent of area used.....4

The MCR1 program is designed to do just this. Weather sources for the test districts were:

Bedford Central.....NOAA, Bedford Hills
H. Hudson Central.....NYS/G&E, Buchanon
Niskayuna Central.....NOAA, Schenectady and Schenectady
Brewster Central.....Local Oil Company

Results of the Process

Because of various delays, data problems and district fallout, only three of the districts could be processed fully into the MCR1 system. Adequate monthly energy data was available on these three for only parts of the period. The final processing included:

H. Hudson Central.....October 1977 - March 1978
Bedford Central.....October 1977 - December 1977
Niskayuna Central.....September 1977 - October 1977

The results of this processing indicated that, in general, the districts were doing somewhat better energy management than at the time they undertook Phase I of the program. Savings were still possible through O & M improvements at many schools. (See sample printout, page B9)

MCR1 and the State Program

The availability of a program such as MCR1 as part of the State energy plan gives another dimension to the energy management effort. Results may be monitored with minimum concern for the effects of external and independent factors such as actual weather and building use.

Figure 11

MONTHLY STUDIES FOR NEW YORK STATE ENERGY PROJECT DATE 05/26/78 PAGE 1

SCHOOL ENERGY USAGE COMPARISON REPORT

DISTRICT NAME BEDFORD CENTRAL
BOX 180
MT KISCO NY 10549

SCHOOL NAME WEST PATENT
SCHOOL ID NO 368 5

	UNIT	CONSUMPTION 11/76	11/77	GUIDELINE 11/77	POTENTIAL SAVINGS 11/77	FISCAL YEAR TO DATE
ELECTRICITY	KWH	35400.	30600.	22419.	8181.	8181.
	DOLLARS	0.	1021.	790.	231.	
ELECTRIC DEMAND	KW	0.	0.			
#4 FUEL OIL	GALLONS	0.	3497.	3278.	219.	691.
	DOLLARS	0.	1423.	1334.	89.	
TOTAL ENERGY USE	MBTU	121.	454.	404.	50.	
	DOLLARS	0.	2445.	2124.	320.	
BTU/SQUARE FOOT		1.7	6.4	5.7		
BTU/DEGREE DAY		162.2	655.8	583.8		

THIS PLANT WAS 36. PER CENT OVER GUIDELINE IN ELECTRICITY DURING NOVEMMER
THIS PLANT WAS 7. PER CENT OVER GUIDELINE IN OTHER FUELS DURING NOVEMMER

NOVEMMER PROGRAM USAGE	DAYTIME HOURS	EVENING HOURS	PCT USED	WEEKEND HOURS	PCT USED
ACADEMIC AREAS	108.	0.	0.	0.	0.
AUDITORIUM/THEATER	0.	0.	0.	0.	
GYMNASIUM	108.	0.	0.	0.	0.

DEGREE DAYS	1976	1977
HEATING	745.	692.
COOLING	0.	3.

B9

102

103

Unlike the GAP4 program which requires relatively large computers, and is operated at most, once a year for each school, MCR1 is written for relatively small computers, and does require frequent usage. As a result, MCR1 should be located closer to the ultimate consumer of its product - the school and the district.

Certain questions and recommendations will be raised or made in this section based on the experiences described in this chapter, and on other EFL experience.

1. The frequency of use of MCR1 has not been determined. Whether it should be used by all districts for all months, or only by those with energy management programs, and then only occasionally, has not been settled. The latter view seems more practical in view of data flow, but the former encourages continual interest and effort.

2. How should the supporting apparatus and personnel be organized?

3. EFL has concluded that each district and/or school should probably be equipped with an inexpensive maximum - minimum temperature thermometer, and should read its own daily weather. Not only would this provide the weather data needed by MCR1, it would have two other useful effects:

   a) Provide the district with this data
   b) Provide a daily activity connected with energy management.

4. An organized and enforced energy reporting system must be created for districts participating in an MCR1 program. Experience seems to indicate the district office as the key point in this system.

APPENDIX C

WORKSHOPS

EFL recommends the workshop concept be used as the primary means of improving the skills of those who will be responsible for participation in the various aspects of the energy management program.

A number of BOCES, as well as some school districts have been conducting workshops on a variety of energy related subjects for groups including board members, administrators, teachers, custodians, students, etc. The majority of such workshops are aimed at improving the skills of operating personnel.

One of the best examples of a workshop program is that conducted by Dr. Bruce Brummitt, Assistant Superintendent for Business, Gloversville Public Schools. Funds for this program, which involved five school districts in the Northern/Westchester BOCES were obtained from a Title IV c Grant.

While this program goes beyond the usual workshop format, it does provide a well organized and fairly complete guide for the organization and content essential for training building operators. In addition, the program provides individual assistance to each operator in his building, through visits by a trainer and building audit by the staff engineer. Program costs are approximately $2,000 per custodian, plus $2,000 to $3,000 for the full engineering audit. Savings have been in the 10 per cent to 30 per cent range.

The program includes a series of four workshops covering the following topics:

Workshop #1

- what can be done and what to expect
- rate clinic covering how to read meters, and compute and analyze bills
- how to use a consulting engineer or architect
- how to appraise your readiness for conservation activities

(Hand outs will include detailed lists of energy saving applications.)

Workshop #2

- scheduling mechanical systems
- problem analysis control systems including zoning and load limiting

Workshop #3

- maintenance of control systems
- boiler maintenance and operation
- operation and maintenance of heating and ventilating systems
- power generation equipment
- heat reclamation systems

(Special emphasis will be placed on energy saving applications.)

Workshop #4

- building program and retrofitting
- building support among parents, principals, pupils and the public in general
- how to develop long and short-term plans

This program is illustrative of the type of workshops that are needed for operating personnel. Many BOCES and some districts have conducted workshops of this type. In addition, those BOCES which have hired energy coordinators, have made these people available to assist districts in a variety of ways, including training district personnel on a more informal basis.

APPENDIX D

CHANGES TO PSECS MATERIAL AND PROCEDURES

Since PSECS materials and procedures are proposed for use in the plan, a detailed explanation of the changes that have been made as a result of this study are presented below. Some of the changes were made in response to user input, while others are the result of engineering analysis, field studies, and experience gained in processing thousands of schools.

1. Data Collection Procedures - The data collection forms have been revised for both elementary and secondary schools. A complete set of directions and sample sheets is provided to more fully explain what is required. There is a single data form for each school which collects all of the information needed for both the Operations and Capital Audits. (See Appendix E.)

   It will be necessary to have trained personnel available in each Region to assist those who will be completing the data form, and to do the form checking required prior to data processing.

2. Data Processing - The procedure used in Phase I required that the data supplied by the district be recoded into numeric form before it was key punched. This was an expensive and time consuming procedure. The district data forms were, therefore, revised to allow key punching directly from the orginal data form, eliminating the recoding process. It is still necessary to review the data for completeness and reasonableness prior to processing.

3. Reporting - The primary communication links between the school district and PSECS are the reports generated by the computer from data supplied by the district. These materials have recently been revised in response to requests from school districts for more explicit recommendations.

The survey recommendations now include suggestions for capital as well as operations and maintenance improvements. Each school receives an instruction manual on How to Conduct Self-Audits, together with the following printouts:

a) PS-8A Energy Conservation Report - Shows the comparison by the PSECS computer programs of each school to a computer model of the school operating on the same schedule, in the same climate, but with minimum energy waste. This comparison provides an estimate of the savings in energy and money possible, through reduction of waste.

b) PS-8B Self-Audit Criteria - Contains recommendations for operating conditions, and procedures which should result in reduced energy waste at the school. These recommendations are specific to each plant, and to various spaces within the plant.

The PS-8B criteria are used in association with the Self-Audit Worksheets, to perform the operations portion of the Self-Audit. A space by space survey is made using the worksheet to record the actual conditions, and schedule of use of each space.

c) PS-8C Survey of Modifications - Analyzes the energy and cost effects of selected specific modifications, including some which require capital investment. Unit costs used in developing the cost/benefit analysis are included as a part of this report. (See Appendix F for examples of these materials.)

APPENDIX E

PUBLIC SCHOOLS ENERGY CONSERVATION SERVICE

FORMS PS-41 AND PS-42

INSTRUCTIONS

PSECS Forms PS-41 and PS-42 are used to describe elementary and secondary schools to the PSECS GAP4 computer program, the latest version in the Guideline Analysis Program (GAP) series. The complexity of each school determines which of the forms is to be used for reporting:

Form PS-41 is used to describe elementary and middle schools, junior high schools, and other schools in which the only specialized spaces are an auditorium, gymnasium and/or multipurpose room.

Form PS-42 is used to describe secondary schools -- high schools, junior-senior high schools, K-12 schools, and vocational schools -- and other schools with extensive special facilities.

As both forms are variants of a master form, the following instructions apply to both forms. Where specific instructions apply to only one form, this will be indicated by an asterisk (*).

DIVISION OF THE SCHOOL INTO COMPONENT SPACES

Because the parts of a school building use energy in different ways, a school described to the GAP4 program must be divided into component spaces. GAP4 accepts three kinds of component spaces. These are:

1. SPECIAL USE SPACES: spaces in which non-classroom activities take place and which usually have special environmental requirements. Examples of such spaces are auditoriums, gymnasiums and shops. On Form PS-41 the only special use spaces are an auditorium, gymnasium or multipurpose room. A list of additional special use spaces is provided for use with the PS-42 form.

2. GENERAL AREAS: consist of all spaces in the school which are not itemized as SPECIAL USE SPACES or PORTABLES. In most schools, the bulk of this type of space is made up of classroom or classroom-type spaces (ie. administrative offices, faculty rooms, etc.)

3. PORTABLES: all portable facilities on the site are grouped into the single category of PORTABLES. While they are described in a manner similar to that used for GENERAL AREAS, they are not part of any GENERAL AREA.

GAP4 permits the user to describe facilities built at different times and/or having significantly different plans, construction,

environmental systems or patterns of use. This is done by placing each such facility on a separate entry line. For example: if an elementary school has classroom wings built in four phases, these might be entered as:

GENERAL AREA A: original building (1926)
GENERAL AREA B: first addition (1952)
GENERAL AREA C: second addition (1965)
GENERAL AREA D: last addition (1974)

The first step in completing these forms is to obtain a small single-line scale drawing of the school and to identify the general areas and special use spaces into which the school is to be divided. A copy of the plan, noting these divisions, should be submitted to PSECS with the completed forms.

GENERAL INSTRUCTIONS FOR COMPLETING BOTH FORMS

1. Print clearly in capital letters and enter only one figure per space. Decimal points, commas, periods, etc., each require one space.

2. Enter all data in pencil and return the pencil original to EFL for processing. Keep a copy.

3. Except where otherwise indicated, all answers are to be right justified; that is, the last digit of the figure is to be inscribed in the rightmost space of the answer blank. This may result in blanks to the left of the figure as the reply space is sized to the largest school anticipated. Do not leave any gaps within the figures as the computer reads these as zero. Where a black dot appears in the upper left corner of an answer blank, figures must be left justified.

4. Except for the unit prices for electricity, fuel, and the figure for per square foot lighting wattage, all figures and codes are whole numbers and do not have decimal points.

5. Read the instruction booklet carefully before filling out the form. If you have any questions, contact EFL.

A

INSTRUCTIONS FOR COMPLETING BOX A

Box A provides general information about the school and is common to both Form PS-41 and PS-42.

Columns A-1 through A-10 — PSECS use only

Column A-11 — School Name

Beginning in the lefthand space under the dot, enter the name of the school, placing one letter per space. If part of the name is an abbreviation, do not place a period after this abbreviation.

A

Leave a blank space whenever a blank occurs in the name. Left Justify.

Column A-31 — Grades Housed

Beginning in the lefthand space under the dot, enter the grades housed in the school. Use the form "n-n" such as "1-6" or "4-8". Kindergarten is abbreviated with a "K". Other abbreviations such as "SP ED" or "VOC" may be used. Left Justify.

Column A-38 — Total Floor Area

Enter the total enclosed floor area of the school in square feet. Include portables. This number should be the total of all floor areas reported in Box D.

Columns A-45 through A-57 — PSECS Use Only

Column A-58 — Regular Session, Average Daily Attendance

Enter the average daily attendance during the regular school session.

Column A-63 — Regular Session, Class Days

Enter the number of class days in the regular session. For full year programs enter the number of class days in the session beginning in September and ending in May or June. The remaining days should be entered under Summer Session, A-71.

Column A-66 — Summer Session, Average Daily Attendance

Enter the average daily attendance during the summer session.

Column A-71 — Summer Session Class Days

Enter the number of class days in the summer session. For full year programs enter the number of days of class not reported in Column A-63.

B

INSTRUCTIONS FOR COMPLETING BOX B

Box B provides information on hot water, food service, heated swimming pools (Form PS-42 only) and base year energy use. On Form PS-41, Columns B-21 through B-32 are left blank.

Columns B-1 through B-10 — PSECS Use Only

Column B-11 — Service Hot Water

Service hot water is the water used for showers, washing hands, etc. Enter the code from the following list that best describes how this water is heated:

Heated by boiler and/or electric heater(s) at least part of the year.....1

B

Heated by boiler and/or gas heater(s) at least part of the year.....2
Heated by boiler and/or oil heater(s) at least part of the year.....3
Heat exchanger from the boiler is the only source of this water.....8

Column B-12 Kitchen Range Fuel

If there is no meal service at the school, skip to column B-21. If there is meal service, enter the code from the following list that best describes the fuel used in the kitchen ranges:

Electricity.....1
Natural Gas or LPG.....2
Fuel Oil.....3

Column B-13 Daily Full Preparation Meals

Enter the average number of hot meals (including breakfast) fully prepared each day in the school kitchen.

Column B-17 Daily Warm Up Meals

Enter the average number of meals prepared elsewhere which are warmed each day in the school kitchen. Include the number of students purchasing hot snack entrees (hot dogs, hamburgers, etc.).

Column B-21 Swimming Pool Heating*

If the form being completed is form PS-41 or if the school does not have a heated pool, skip to Column B-33. If the school has one or more heated swimming pools, enter the code that best describes how the pool is heated:

Electric pool heater.....1
Natural gas pool heater.....2
Fuel oil pool heater.....3

Pool is heated by Boiler Group 1.....6
Pool is heated by Boiler Group 2.....7
Pool is heated by Boiler Group 3.....8
Pool is heated by Boiler Group 4.....9

Column B-22 Swimming Pool Surface Area*

Enter the total water surface area of all heated swimming pools.

Column B-27 Water Temperature*

Enter the water temperature (degrees Fahrenheit) of the pool.

Column B-29 Days Heated*

Enter the number of days during which pool water was heated.

Column B-32 Swimming Pool Cover*

If the heated swimming pool has a cover, enter a "1".

Column B-33 Base Year Electrical Usage

Enter the total electrical usage in Kilowatt-hours (KWH) during the base year.

Column B-41 Base Year Peak Electric Demand

Enter the single peak electrical demand recorded during the base year if this figure is available.

Column B-46 Electricity, Present Unit Cost/KWH

Enter the present cost per KWH for electrical energy. If a rate schedule covering this school is being submitted, leave this column blank and the program will select an appropriate figure from the rate schedule. If a figure is entered, enter it in decimal dollars and cents form, e.g. "three cents" is "0.03". Left Justify.

Column B-51 Primary Fuel Type

Enter the code that best describes the major fuel used in the school:

*All electric	10
Natural gas, therms	21
Natural gas, CCF	22
Natural gas, MCF	23
LPG, gallons	25
No. 2 fuel oil, gallons	31
No. 4 fuel oil, gallons	32
No. 5 fuel oil, gallons	33
No. 6 fuel oil, gallons	34
Hard coal, tons	41
Soft coal, tons	42
Street or purchased steam, MLBS	51

*In this column only: if the plant is all-electric and all electrical service is on one meter, enter code "10"; if the plant is all-electric and the heating power is metered separately, enter code "11" and enter the non-heating usage in Column B-33 and the heating usage in Column B-53.

Column B-53 Primary Fuel, Base Year Usage

Enter the primary fuel usage in the units described in Column B-51 for the base year.

Column B-60 Primary Fuel, Present Unit Price

If the primary fuel is purchased on a rate schedule and a copy of this schedule is attached, leave this column blank. If there is a unit price, enter this price using decimal dollars and cents form, e.g. "forty cents" is "0.40"?

B

Column B-65 — Secondary Fuel Type

If there is no secondary fuel, skip the remainder of Box B. If there is a secondary fuel, enter the code from those listed for Column B-51 that best describes this fuel.

Column B-67 — Secondary Fuel, Base Year Usage

Enter the total usage of the secondary fuel in the units described in Column B-51 for the base year.

Column B-74 — Secondary Fuel, Present Unit Cost

If this fuel is purchased on a rate schedule and a copy of this schedule is attached, leave this column blank. If there is a unit price, enter the present unit price in decimal dollars and cents form, e.g. "ten dollars and fifty cents" is "10.50". Left Justify.

C

INSTRUCTIONS FOR COMPLETING BOX C

On both forms Box C provides space for describing boilers and chillers. PS-42 provides space for describing special equipment and site lighting as well.

Boilers and chillers often function together in clusters of two or three, interconnected by controls and piping. Such clusters should be recorded as distinct boiler and chiller groups. They must be designated as separate groups if any of the following conditions are met: they are not interconnected by controls or piping; they are in different parts of the building; they are different kinds of boilers or chillers; they heat or cool different parts of the school or special loads.

The GAP4 computer program attempts to assign energy loads to the boiler or chiller groups which service them. Those spaces coded as being treated by a given boiler or chiller group, are linked with the appropriately numbered group in Box C.

There is no hard and fast rule for determining when a boiler or chiller (or group) is "central" or not. Small package units (boilers) serving two or three rooms or less than 15,000 square feet, or 25 tons of cooling (chillers) should not be considered as "central" units.

Columns C-1 through C-10 — PSECS Use Only

Column C-11 — Central Boiler Type

Enter the code that best describes the type of boiler(s) which make up each central group:

Large boilers, including those with high and low fire

Steam boiler(s).....1
Hot water boiler(s).....2

Steam boiler(s) converting hot water.....3

True Modular Boilers capable of sectional firing

Modular steam boiler(s).....4
Modular hot water boiler(s).....5

Column C-12 Number in Group

Enter the number of boilers in each group.

Column C-13 Input Rating, Lead Boiler

Enter the input rating of the lead boiler - the boiler that is fired most often - as 1000's of Btu/hr, not as Btu/hr. For example: 300,000 Btu/hr. = 300 Mbh. If the rating can not be found, leave this column blank and the computer will estimate the rating.

Column C-18 Primary Fuel

Enter the code that best describes the primary fuel for each boiler group:

Electricity.....1
Natural gas, propane or butane.....2
Fuel oil.....3
Coal.....4
Other.....5

Column C-19 Alternate Fuel

If the boiler group can operate on an alternate fuel, enter the code from the above list that best describes this second fuel.

Column C-20 Boiler Group Operation

Enter the code that best describes how each boiler group is operated.

One boiler only in group

Boiler only fired when needed and/or on clock-timer.....1
Boiler fired continuously during load period reported.....3

Two or more boilers in group

Boilers fired only when needed and/or on clock-timers.....1
Lead boiler fired during bulk of reported load period, lag on only as needed.....2
All boilers on fire for bulk of load period.....3

If boiler group is the only source of domestic or service

C

hot water for part or all of the school, enter a "4" in this column.

Column C-21 — Combustion Efficiency

Enter as a percentage, the combustion efficiency of the lead boiler of each group.

Column C-23 — Days Lead Boiler Fired

Enter the number of days (or best estimate) on which the lead boiler was fired during the base year. Count as a day of firing any day on which (a) the boiler was lit and (b) the boiler was hot. Low or partial fire counts as a full day.

Column C-26 — Central Chiller Type

If there are no central chillers in the school, skip to Column C-33. If chillers are present, enter the code that best describes the chillers in each group:

Electric reciprocating.....1
Electric centrifugal.....2
Absorption (gas, steam or hot water).....3
Compressor driven by steam turbine.....4
Compressor driven by natural gas engine.....5

Column C-27 — Number in Group

Enter the number of chillers in each group.

Column C-28 — Cooling Tower

Enter "1" if the group has a cooling tower; "2" if there is an air-cooled compressor. Otherwise leave blank.

Column C-29 — Chiller Fuel

Enter the code that best describes the fuel used (or heat source) in each group:

Electricity.....1
Natural Gas.....2
Fuel Oil.....3

Hot water or steam from Boiler Group 1.....6
Hot water or steam from Boiler Group 2.....7
Hot water or steam from Boiler Group 3.....8
Hot water or steam from Boiler Group 4.....9

Column C-30 — Rated Tons

Enter the total cooling tonnage for the chillers in each group. If the units are rated in BTU, convert to tons by dividing by 12,000.

Column C-33 Special Equipment Fuel

Using the following fuel codes, enter the type of fuel used by each item of special equipment:

Electricity.....1
Natural gas.....2
Fuel Oil.....3

Column C-34 Special Equipment Rating*

Enter the input rating for each item of special equipment. Electricity should be expressed in KW, gas and oil in KBTU.

Column C-39 Hours Used, Regular Session*

Enter the hours the special equipment was used during the regular (September to May or June) school session.

Column C-42 Hours Used, Summer Session*

Enter the hours the special equipment was used during the summer session.

Column C-45 Installed KW, Site Lighting*

Enter the installed kilowatts (KW) of site lighting by category.

Columns C-49, C-52, C-55, C-58 Hours per Week Use*

Enter the number of hours per week for each season that each type of site lighting was used.

D

INSTRUCTIONS FOR COMPLETING BOX D

Box D provides for the description of the component spaces of the school. Component spaces are divided into three categories:

1. SPECIAL USE SPACES
2. GENERAL AREAS
3. PORTABLES

Additional discussion of these spaces types can be found on pages 1 and 2.

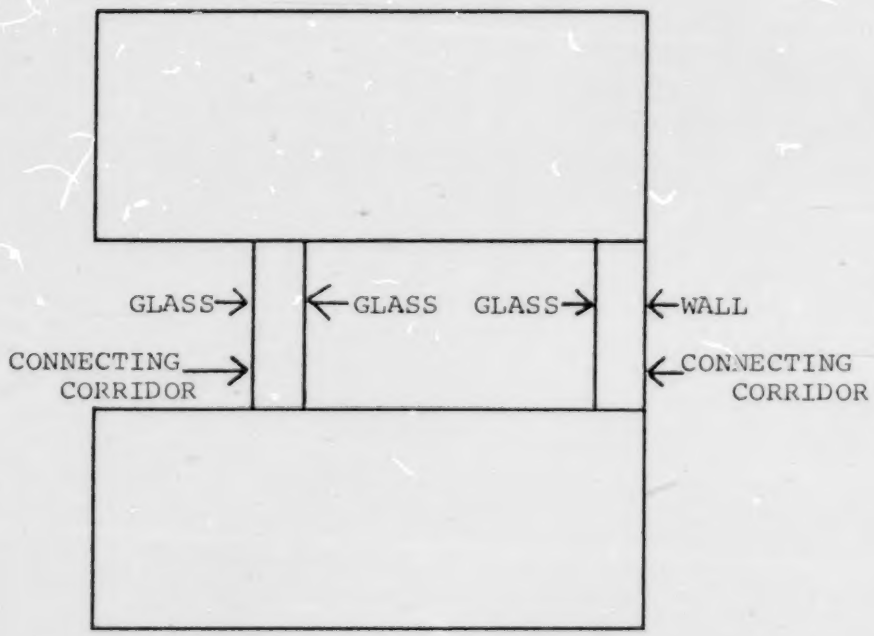
Form PS-42 allows the user to identify and describe a number of SPECIAL USE SPACES in addition to entries for several GENERAL AREAS and PORTABLES. A listing containing all current candidate spaces is provided with each PS-42 form. The user is cautioned to make the simplest possible description of the school while making sure that spatial differences are adequately described.

GAP4 classifies spaces according to patterns of energy use. this classification system recognizes eight major space types:

1. Large assembly spaces (codes 11-20)
2. Gymnasium type spaces (codes 21-29)
3. Swimming pool enclosures (code 30)
4. Shower/locker rooms (codes 31-40)
5. Shop type spaces (codes 41-59)
6. Kitchens (code 60)
7. Large academic type spaces (codes 61-70)
8. Classroom, circulation and supporting spaces (codes 81-89)

Within each major space type, finer distinctions in energy use patterns can be identified. These are reported to the GAP program as subdivisions of the major space type, e.g. Girl's Gymnasium, Wood Shop. One broad descriptive term such as "Shops" is provided for each space type. If all shop-type spaces in a school were built at the same time, have the same systems and are used in much the same way, the entire group may be reported as "Shops." If, however, one shop is used on a different schedule, this shop should be reported separately.

A special line coded "80" may be used if the school has environmentally treated glass-walled corridors connecting buildings or parts of buildings. Such corridors might be characterized as glass tubes or tunnels. If the corridors are not treated, they may be regarded as "unenclosed" area, and need not be recorded on the forms.



D

Columns D-1 through D-7 — Special Space Name

Write the name of each space reported as an entry in the blank area under Columns D-1 through D-7 on the form. (PS-42 only)

Column D-8 — Space Type Code

If you are completing PS-42, enter the code from the list provided that describes the space being entered.

CODES FOR SPACE TYPES

11	Auditorium	50	Greenhouse
12	Theater	-	
13	Large Commons	59	Bus Garage/Storage
14	Large Group Instruction		
15	Multi-purpose	60	Kitchen
		61	Cafeteria
21	Gymnasium	62	Administrative A
22	Girl's Gymnasium	63	Administrative B
23	Boy's Gymnasium	64	Administratvie C
24	Auxiliary Gymnasium	65	Library/Media Center
25	Small gymnasium	66	Music Room
26	Field House	67	Computer Room
30	Pool Enclosure	80	Connecting Corridor
31	Shower/Locker	81	General Area 1
32	Girl's Shower/Locker	82	General Area 2
33	Boy's Shower/Locker	83	General Area 3
34	Pool Shower/Locker	84	General Area 4
35	Team Shower/Locker	-	
		89	Portables
41	Shops		
42	General Shop		
43	Auto Shop		
44	Wood Shop		
45	Metal Shop		
46	Agriculture Shop		
47	Print Shop		
48	Machine Shop		
49	Construction Shop		

Column D-11 — Year Opened

Enter the last two digits of the year the space was opened for the first time. If prior to 1900, enter "00".

Column D-13 — Plan Type

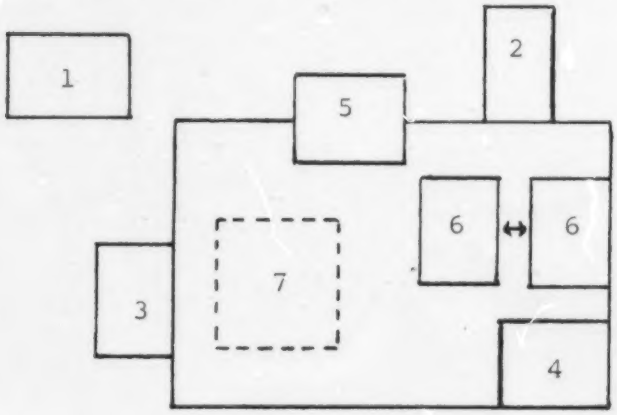
Enter the code that best describes the plan configuration of the space from one of the following lists.

If the space is a SPECIAL USE SPACE:

Freestanding.....1
Attached to another space by short side..2

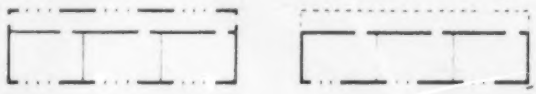
D

Attached to another space by long side...3
Attached to another space by two sides...4
Partially enclosed (attached by three or more sides).....5
Attached by three sides or fully enclosed.....6
Space in basement, no outside walls.....7

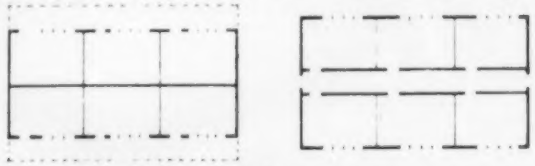


If the space is a GENERAL AREA or PORTABLE:

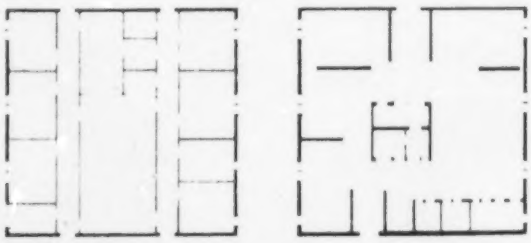
Single-loaded corridor.....1
Double-loaded corridor.....2
Compact plan (has interior rooms).....3
Compact plan with courtyard(s).....4



Single-loaded corridor.....1



Double-loaded corridor.....2



Compact or pod plan.....3
As 3, but with interior courts.....4

Column D-14 Exterior Classrooms

Skip this column for SPECIAL USE SPACES.
For GENERAL AREAS and PORTABLES, enter the number of classrooms and classroom equivalents with an exterior exposure (at least one outside wall).

Column D-16 Number of Buildings

Skip this column for SPECIAL USE SPACES.
For GENERAL AREAS and PORTABLES, enter the number of buildings in each GENERAL AREA or PORTABLE. If the number is greater than nine, use an additional entry line for the remaining buildings, and code the rest of the line identically to the first.

Column D-17 Floor Area

Enter the floor area of each space making sure to record each space only once. The sum of the areas reported in Column D-17 should equal the total floor area reported in Column A-38.

Column D-23 Roof Area

Enter the roof area of each space. Do not include overhangs or covered walkways. If the space is beneath other treated spaces and has no exposed roof, leave this column blank.

Column D-29 Skylight Area

Enter the area of all skylights in the space. NOTE: the reported roof area, Column D-23, includes the area of skylights.

Column D-33 Roof Code

Enter the code from the list in Appendix 1 that best describes the construction and insulation of the roof.

Column D-35 Wall Code

Enter the code from the list in Appendix 2 that best describes the construction and insulation of the solid portion of the exterior walls.

Columns D-37 through D-52

For GENERAL AREAS and PORTABLES these columns describe a TYPICAL (or representative) CLASSROOM or classroom equivalent. Enter data for a single classroom unit only; not for the entire space. For SPECIAL USE SPACES the descriptions apply to the space as a whole.

Column D-37 Number of Exterior Doors

Enter the number of doors opening directly to the outdoors in a TYPICAL CLASSROOM.

D

Column D-38 Lighting Watts per Square Foot

Enter the watts per square foot of installed lighting in each SPECIAL USE SPACE or TYPICAL CLASSROOM. This is calculated by dividing the total wattage of all lamps in the space by the floor area. For fluorescent and mercury vapor lights, do not include an allowance for ballasts. Enter in decimal form, such as "1.5" or "2.0".

Column D-41 Lighting Type

Enter the code that best describes the predominant type of lighting in the space:

Incandescent.....1
Fluorescent.....2
Mercury vapor or other HID.....3

Column D-42 Window Area: Double-glass or glass-block

Enter the square foot area of double-glass and/or glass-block in the space.

Column D-45 Window Area: Single or float-glass

Enter the square foot area of single-sheet glass in the space.

Column D-49 Window Condition

Enter the code that best describes the condition of the windows:

Tight fitting, little air leakage.....1
Medium fitting, some air leakage.....2
Loose fitting, considerable air leakage.....3

Column D-50 Daytime Temperature

For each space enter the daytime setting of the thermostat during the heating season.

Column D-52 Nighttime Temperature

If the heating system operates at night to maintain a given temperature, enter that temperature for each space. If the system is not operated at night or is operated only to protect against freezing, leave this column blank.

Columns D-54 through D-62 Mechanical Systems

Describe the mechanical system of each SPECIAL SPACE, GENERAL AREA or PORTABLE. In reporting these systems, it may be necessary to ignore some elements of the system such as radiators at outside doors and occasional small room fans. GAP4 provides for exhaust fans for closets, laboratories and toilet rooms so these need not be considered.

Column D-54 Non-Outside Air Heating

If the space has a heating system that does not provide outside air (see list below) enter the code that best describes this system. If the area does not have such a system, skip to D-56. If the space has both outside air and non-outside air systems enter data here and at D-56.

Radiators, radiant panels and/or supplementary perimeter system.....1
Unit heater(s), fan coil unit(s).....2
Furnace(s).....3
Residential type heat pump(s).....6

Column D-55 Source of Heat

Enter the code that best describes the source of heat for the non-outside air heating system:

Hot water or steam from Boiler Group 1.....1
Hot water or steam from Boiler Group 2.....2
Hot water or steam from Boiler Group 3.....8
Hot water or steam from Boiler Group 4.....9
Electric coils.....3
Direct-fired gas unit.....4
Direct-fired oil unit.....5
Small packaged boilers (less than 250 Mbh)...7

Column D-56 Outside Air System, Supply

Enter the code that best describes the manner in which outside or fresh air is introduced into each area:

Through window(s) only.....blank
Transfer air from another area.....1
Large fans located in central fan rooms, "house fans".....2
Unit ventilator(s).....4
Single-duct or single-zone systems.....5
Heat pump systems.....6
Multizone or dual-duct systems.....7
Variable air volume systems.....8

House fan systems (code "2") are typically found in schools built prior to World War II and have fixed outside air volumes.

Column D-57 Outside Air System, Exhaust

Enter the code that describes how room air is exhausted from the area.

Through windows only.....blank
Gravity Relief.....1
Powered exhaust fans (not including closet or toilet room exhausts).....3
Transfer of air to another area.....4

Return to air-supply system
through ducts.....5
through a ceiling plenum.....6

Column D-58 Source of Heat

If the air in the supply system (see Column D-56) is not heated, or if the heating in this system is rarely used, leave this column blank. If there is heating enter the code from the list for Column D-55 that best describes the source of this heat.

Column D-59 Percent Cooled

Enter the percentage category of the floor area that is cooled by the air supply system:

0 to 10 percent.....blank
11 to 25 percent.....1
26 to 50 percent.....2
51 to 75 percent.....3
76 to 100 percent.....4

Column D-60 Source of Cooling

If the air supply system, or any part of it is capable of providing cooled air, enter the code that best describes the method by which air is cooled:

Direct expansion (DX) coils.....1
Chilled water or glycol
from Chiller Group 1.....2
from Chiller Group 2.....3
from Chiller Group 3.....8
from Chiller Group 4.....9
Evaporative or swamp cooler(s).....5
Heat pump(s).....6

Column D-61 Reheat

If after initial cooling of the air-stream, a portion of the supply air is heated again ("reheat") before delivery to the space, enter the code that best describes how this reheating is accomplished:

Steam from a boiler(s).....1
Hot water from a boiler(s).....2
Electric coils.....3
Coils using refrigerant gas.....4

Column D-62 Number of Air Supply Units

If an air-supply system, other than windows or transfer air is reported in Column D-56, enter the number of air supply units serving the area.

Columns D-64 through D-80 Scheduling Information

Describe the school's educational program schedule in these columns. Utilization for a typical day falls into two distinct categories: 1) Regular or day session use (all use prior to approximately 6 p.m.) 2) Evening use, (all use after approximately 6 p.m.).

MONDAY-FRIDAY

Regular Session (September to June)

Column D-64 Days per Week

Enter the number of days per week (Mon.-Fri.) that the space is normally used.

Column D-65 Hours per Day

Enter the number of hours the space is used during the normal school day.

Summer Session (June to September)

Column D-67 Days Used

Enter the number of week days each space is used during the summer session.

Column D-69 Days per Week

Enter the number of days per week (Mon.-Fri.) that the space is used.

Column D-70 Hours per Day

Enter the number of hours per day (Mon.-Fri.) each space is used.

Column D-71 Percent Quartile Used

Enter the code that best describes the portion of the GENERAL AREA or PORTABLES used during this period:

1 to 25 percent.....1
26 to 50 percent.....2
51 to 75 percent.....3
76 to 100 percent.....4

SATURDAY-SUNDAY

Column D-72 Days per Year

Enter the number of weekend days that each space is used .

Column D-74 Hours per Day

Enter the number of hours each space is used on a typical weekend day.

D

Column D-75 — Percent Quartile Used

Enter the code that best describes the portion of the GENERAL AREA or PORTABLES used during this period:

1 to 25 percent.....1
26 to 50 percent.....2
51 to 75 percent.....3
76 to 100 percent.....4

EVENINGS

Column D-76 — Nights per Year

Enter the number of evenings each space is used.

Column D-79 — Hours per Evening

Enter the number of hours each area is used on a typical evening.

Column D-80 — Percent Quartile Used

Enter the code that best describes the portion of each GENERAL AREA or PORTABLE used each evening:

1 to 25 percent.....1
26 to 50 percent.....2
51 to 75 percent.....3
76 to 100 percent.....4

APPENDICES

ROOF AND WALL CODES

In Column D-33 and Column D-35 the respondent is asked to describe the roof and wall of given portions of the school, using the codes in the following lists. These codes describe the basic construction of the roof or wall and whether or not additional materials have been added to this basic fabric for energy conservation or other purposes.

In using these lists, first select the general nature of the element, such as a SOLID BRICK wall; then go through the list and select the best and most complete description of the element.

APPENDIX 1

Column D-33 — ROOF CODES

Enter the code that best describes the roof type for a given space.

Roof	Code
CONCRETE DECKING	
Lightweight concrete, roofing, form board	61
with no suspended ceiling	61
and 1" of insulation	67
and 2" of insulation	68
and vermiculite fill	68
and 3" of insulation	69
with a suspended ceiling	62
and 1" of insulation	64
and 2" of insulation	65
and vermiculite fill	65
and 3" of insulation	66
Heavyweight concrete, roofing, form board	71
with no suspended ceiling	71
and 1" of insulation	77
and 2" of insulation	78
and vermiculite fill	78
and 3" of insulation	79
with a suspended ceiling	72
and 1" of insulation	74
and 2" of insulation	75
and vermiculite fill	75
and 3" of insulation	76

(Note: Most concrete, especially that used in pre-World War II buildings, is heavyweight concrete)

ROOF CODES (continued)

METAL DECKING

with roofing	51
and no suspended ceiling	51
and 1" of insulation	57
and 2" of insulation	58
and vermiculite fill	58
and 3" of insulation	59
and a suspended ceiling	52
and batt insulation	53
and 1" of insulation	54
and 2" of insulation	55
and vermiculite fill	55
and 3" of insulation	56

MINERAL FIBER DECKING (e.g. Tectum) and roofing

	2" tectum	3" tectum
and no suspended ceiling	31	41
and 1" of insulation	37	47
and 2" of insulation	38	48
and vermiculite fill	38	48
and 3" of insulation	39	49
and a suspended ceiling	32	42
and batt insulation	33	43
and 1" of insulation	34	44
and 2" of inuslation	35	45
and vermiculite fill	35	45
and 3" of insulation	36	46

WOOD DECKING	1" wood	2" wood
decking with roofing		
and no suspended ceiling	11	21
and 1" of insulation	17	27
and 2" of insulation	18	28
and 3" of insulation	19	29
and a suspended ceiling	12	22
and batt insulation	13	23
and 1" of insulation	14	24
and 2" of insulation	15	25
and 3" of insulation	16	26

Portables	
without insulation	12
with insulation	13

PITCHED ROOF WITH ATTIC

Asphalt shingles	96
with inside sheathing	92
and 2-1/2" batts	93
and 3-1/2" batts	94

Clay tile - use above figures

APPENDIX 2

Column D-35 — WALL CODES

Select the code that best describes the wall type for a given space.

Wall	Code
CONCRETE BLOCK	
8" block	31
filled with vermiculite	32
with 1" insulation	33
with 2" insulation	34
12" block	35
filled with vermiculite	36
with 1" insulation	37
with 2" insulation	38
SOLID BRICK	
8" thick, no cavity, plaster	11
with lath and plaster	12
with insulating board and plaster	13
12" thick, no cavity, plaster	15
with lath and plaster	16
with insulating board and plaster	17
BRICK ON CONCRETE BLOCK	
8" thick, no cavity	21
with cavity (1" air space)	22
and insulating board	23
block vermiculite filled	24
4" block, no cavity	25
with cavity (1" air space)	26
and insulating board	27
block vermiculite filled	28
BRICK VENEER ON WOOD OR STEEL STUD WALL	41
with R=7 batts included	42
with R=9 batts included	43
WOOD SIDING ON WOOD OR STEEL STUDS	51
with R=7 batts included	52
with R=9 batts included	53
STUCCO ON WOOD OR STEEL STUDS	54
with R=7 batts included	55
with R=9 batts included	56

WALL CODES (Continued)

CURTAIN WALL, STOREFRONT OR INSULATED PANELS

with no insulation	57
with 1" insulation	58
with 2" insulation	59

PORTABLES

without insulation	57
with insulation	58

CONCRETE WALL

4" or 6" thick, no insulation	61
with 1" insulation	62
with 2" insulation	63
8" thick, no insulation	65
with 1" insulation	66
with 2" insulation	67

Figure 12

DISTRICT SAMPLE — The base year for this form is: 7778 — If another base year is used, enter here:

PSECS USE ONLY

PS 41 ELEMENTARY FORM

A GENERAL

	SCHOOL NAME	GRADES HOUSED	TOTAL FLOOR AREA SQ. FT.	REGULAR SESSION AVERAGE DAILY ATTEND.	REGULAR SESSION CLASS DAYS	SUMMER SESSION AVERAGE DAILY ATTEND.	SUMMER SESSION CLASS DAYS
01259006 00	T J JACKSON	K-8	65608	965	180	150	30

B HOT WATER FOOD SERVICE ENERGY USE

	SERV. HW	FOOD SERVICE FUEL	FOOD SERVICE # DAILY FULL PREP MEALS	FOOD SERVICE # DAILY WARM UP MEALS	PSECS USE ONLY	ELECTRICITY BASE YEAR USAGE KWH	ELECTRICITY DEMAND	ELECTRICITY PRESENT COST/KWH	PRIMARY FUEL TYPE	PRIMARY FUEL BASE YEAR USAGE	PRIMARY FUEL PRESENT UNIT PRICE	SECONDARY FUEL TYPE	SECONDARY FUEL BASE YEAR USAGE	SECONDARY FUEL PRESENT UNIT PRICE
03	2	2	338			264240	131	0.022	23	10200	0.88			

C CENTRAL BOILERS & CHILLERS

	BOILERS TYPE	BOILERS NUMBER	BOILERS INPUT RATING LEAD (MBH)	BOILERS FUEL 1	BOILERS FUEL 2	BOILERS OPER.	BOILERS COMB. EFFECT	BOILERS # DAYS LEAD FIRED	CHILLERS TYPE	CHILLERS NUMBER	CHILLERS TOWER	CHILLERS FUEL	CHILLERS RATED TONS
GROUP 1 08	1	2	17002	2		272	125						
GROUP 2 09													

BOX B

COL. 11 SERVICE HOT WATER: Boiler and/or electric heaters(s) 1; Boiler and/or gas heater(s) 2; Boiler and/or oil heater(s) 3; Boiler only source 8

COL. 12 FUELS: Electricity 1; Natural gas or LPG 2; Oil 3; Coal 4; Wood, steam 5

COL. 51, 65 FUEL TYPE: All-electric 10; Natural gas, therms 21; Natural gas, CCF 22; Natural gas, MCF 23; LPG, gallons 25; No. 2 Fuel Oil, gallons 31; No. 4 Fuel Oil, gallons 32; No. 5 Fuel Oil, gallons 33; No. 6 Fuel Oil, gallons 34; Hard Coal, tons 41; Soft Coal, tons 42; Street Steam, MLBS 51

BOX C

COL. 11 BOILER TYPE: Steam 1; Hot water 2; Modular steam 4; Modular hot water 5

COL. 18, 19, 29 FUELS (See Box B12 for fuel codes)

COL. 30 BOILER OPERATION: Boilers used only as needed 1; Lead on, lag as needed 2; All on line during load period 3

COL. 26 CHILLER TYPE: Electric reciprocating 1; Electric centrifugal 2; Absorption 3; Steam turbine 4; Gas engine 5

COL. 28 COOLING TOWER: Cooling tower 1; Air-cooled 2

D BUILDING CONSTRUCTION MECHANICAL SYSTEMS SCHEDULE

	DESCR. YEAR OPENED	DESCR. PLAN	DESCR. # EXT. CLASSRMS	DESCR. # BLDGS	FLOOR AREA SQ. FT.	ROOF AREA SQ. FT.	ROOF SKYLIGHT AREA SQ. FT.	ROOF CODE	WALL CODE	EXT. DOORS	LIGHTS WATTS/SQ. FT.	LIGHTS TYPE	WINDOW AREA GL-BLK DBL-GL SQ. FT.	WINDOW AREA SINGLE GLASS SQ. FT.	WINDOW AREA COND	TEMP. DAY	TEMP. NIGHT	MECH. SYS. NON AIR TYPE	AIR HEAT	AIR SUPPLY	AIR EXHAUST	COOL HEAT	COOL % COOLED	COOL SOURCE	COOL REHEAT	# AIR UNITS	MON.-FRI. REG. DAYS/WK.	MON.-FRI. REG. HRS./DAY	MON.-FRI. SUMMER DAYS/YEAR	MON.-FRI. SUMMER DAYS/WK.	MON.-FRI. SUMMER HR./DAY	MON.-FRI. SUMMER % USED	SAT.-SUN. DAYS/YEAR	SAT.-SUN. HRS/DAY	SAT.-SUN. % USED	EVENING NIGHTS/YEAR	EVENING HRS/DAY	EVENING % USED
AUDITORIUM 11																																						
GYMNASIUM 21	62	1			8000	8000		28	22		1.53			2502	65				531							5	7	30	54			103			503		
GEN'L AREA 1 01	26	2	1	51	26400	13200		10092	11		1.92			1923	6860	11										5	7	30	54	1	1	031		3931		
GEN'L AREA 2 02	59	2	1	01	17600	17600		28	22		2.12			2242	6860			411								5	7										
GEN'L AREA 3 03	62	1	8	1	9000	9000		28	22		2.12			2242	6860			411	21							5	7	30	54	1		531					
GEN'L AREA 4 04																																						
PORTABLES 09	70	3	5	5	4608	4608		1553	11		1.52			320	168		13									5	7										

ANSWER FOR TYPICAL CLASSROOM

TOTAL FLOOR AREA (MUST = A 38) 65608

PSECS PUBLIC SCHOOLS ENERGY CONSERVATION SERVICE

PLEASE REFER TO THE INSTRUCTION MANUAL BEFORE STARTING WORK ON THIS FORM.
If you have questions, contact:
EFL, 3000 Sand Hill Rd. Menlo Park, CA 94025
(415) 854 2300

BOX D

COL. 13 PLAN TYPE (Special Spaces Lines 11 & 21): Freestanding 1; Attached by short side 2; Attached by long side 3; Attached by two sides 4; Partially enclosed 5; Fully enclosed 6; (Gen'l Areas Lines 01 to 09): Single-loaded corridor 1; Double-loaded corridor 2; Compact, big room, pods 3; As 3 but with interior courts 4

COL. 33, 35 ROOF, WALL INSULATION: See Appendices 1 and 2 for codes

COL. 41 LIGHTING TYPE: Incandescent 1; Fluorescent 2; Mercury vapor, other HID 3

COL. 49 WINDOW CONDITION: Tight fit, little air leakage 1; Medium fit, some air leakage 2; Loose fit, great air leakage 3

NON-OUTSIDE AIR SYSTEMS

COL. 54 TYPE: Radiators, radiant panels 1; Unit heater(s), fan coil unit(s) 2; Furnace(s) 3; Heat pump(s) 6

COL. 55 & 56 HEAT SOURCE: Hot water or steam, Boiler Group 1 1; Hot water or steam, Boiler Group 2 2; Electric coils 3; Direct-fired gas 4; Direct-fired oil 5; Not heated (56 only) blank

AIR SYSTEMS

COL. 50 TYPE: Windows only 1; Transfer air 2; House fans 3; Unit ventilators 4; Single duct, single zone 5; Heat pump(s) 6; Multizone, dual duct 7; Variable volume 8

COL. 57 EXHAUST: Windows only blank; Gravity relief 1; Powered fans 3; Transfer air 4; Return to system - ducted 5; Return to system - plenum 6

COL. 58 HEAT SOURCE (See COL. 55)

COOLING

COL. 59 PER CENT COOLED: 0 to 10 per cent blank; 11 to 25 per cent 1; 26 to 50 per cent 2; 51 to 75 per cent 3; 75 to 100 per cent 4

COL. 60 COOLING SOURCE: Direct expansion (DX) 1; Chilled water from chiller #1 2; Chilled water from chiller #2 3; Evaporative (swamp) coolers(s) 5; Heat pump 6

COL. 61 REHEAT: Steam 1; Hot water 2; Electricity 3; Hot refrigerant gas 4

COL. 71, 73, 80 PER CENT USED: 1 to 25 per cent 1; 26 to 50 per cent 2; 51 to 75 per cent 3; 76 to 100 per cent 4

* indicates starting point for that item only. All other items are right justified.

Figure 13

DISTRICT SAMPLE — The base year for this form is: 76/77 — If another base year is used, enter here:

PSECS USE ONLY

PS 42 SECONDARY FORM

A GENERAL

SCHOOL NAME	GRADES HOUSED	TOTAL FLOOR AREA SQ. FT.	REGULAR SESSION AVERAGE DAILY ATTEND.	REGULAR SESSION CLASS DAYS	SUMMER SESSION AVERAGE DAILY ATTEND.	SUMMER SESSION CLASS DAYS
500601 00 HIGH SCHOOL	9-12	156956	1050	180	150	30

B HOT WATER FOOD SERVICE ENERGY USE

	SERV. HW	FOOD SERVICE: FUEL	FOOD SERVICE: # DAILY FULL PREP MEALS	FOOD SERVICE: # DAILY WARM UP MEALS	POOL: HEAT	POOL: SURFACE AREA SQ. FT.	POOL: WATER TEMP	POOL: # DAYS HEATED	POOL: COVER	ELECTRICITY: BASE YEAR USAGE KWH	ELECTRICITY: DEMAND	ELECTRICITY: PRESENT COST/KWH	PRIMARY FUEL: TYPE	PRIMARY FUEL: BASE YEAR USAGE	PRIMARY FUEL: PRESENT UNIT PRICE	SECONDARY FUEL: TYPE	SECONDARY FUEL: BASE YEAR USAGE	SECONDARY FUEL: PRESENT UNIT PRICE
03	B									725800			32	92890				

C CENTRAL BOILERS & CHILLERS

	BOILERS: TYPE	BOILERS: NUMBER	BOILERS: INPUT RATING LEAD (MBH)	BOILERS: FUEL 1	BOILERS: FUEL 2	BOILERS: OPER.	BOILERS: COMB. EFFECT	BOILERS: # DAYS LEAD FIRED	CHILLERS: TYPE	CHILLERS: NUMBER	CHILLERS: TOWER	CHILLERS: FUEL	CHILLERS: RATED TONS
GROUP 1 06	1	2	4185	3		3		247	2	2	2	1	31
GROUP 2 07													
GROUP 3 08													
GROUP 4 09													

SPECIAL EQUIPMENT

	FUEL	INPUT RATING KBTU or KW	TOTAL HOURS REG. SESSION	TOTAL HOURS SUMMER SESSION
KILNS/FORGES	1	1	4432	72
KILNS/FORGES				
KILNS/FORGES				
OTHER				

SITE LIGHTING

	INSTL. KW	H/W FALL	H/W WINTER	H/W SPRING	H/W SUMMER
PARKING	16	40	56	40	35
SECURITY					
ATHLETICS					
OTHER					

PSECS PUBLIC SCHOOLS ENERGY CONSERVATION SERVICE

PLEASE REFER TO THE INSTRUCTION MANUAL BEFORE STARTING WORK ON THIS FORM.
If you have questions contact:
EFL, 3000 Sand Hill Rd., Menlo Park, CA 94025
(415) 854-2300

BOX B

COL. 11 SERVICE HOT WATER
Boiler and/or electric heaters(s) 1
Boiler and/or gas heater(s) 2
Boiler and/or oil heater(s) 3
Boiler only source 6

COL. 12 FUELS
Electricity 1
Natural gas or LPG 2
Oil 3
Coal 4
Wood, steam 5

COL. 21 POOL HEATING
Electric pool heater 1
Natural gas pool heater 2
Oil pool heater 3
By Boiler Group 1 6
By Boiler Group 2 7
By Boiler Group 3 8
By Boiler Group 4 9

COL. 32 POOL COVER
No cover blanks
Cover 1

COL. 51, 65 FUEL TYPE
All-electric 10
Natural gas: therms 21
Natural gas: CCF 22
Natural gas: MCF 23
LPG, gallons 25
No. 2 Fuel Oil, gallons 31
No. 4 Fuel Oil, gallons 32
No. 5 Fuel Oil, gallons 33
No. 6 Fuel Oil, gallons 34
Hard Coal: tons 41
Soft Coal: tons 42
Street Steam: MLBS 51

BOX C

COL. 11 BOILER TYPE
Steam 1
Hot water 2
Steam boiler converting to hot water 3
Modular steam 4
Modular hot water 5

COL. 18, 19, 29, 33 FUELS
(See Box B12 for fuel codes)

COL. 30 BOILER OPERATION
Boilers used only as needed 1
Lead on, lag as needed 2
All on line during load period 3

COL. 28 CHILLER TYPE
Electric reciprocating 1
Electric centrifugal 2
Absorption 3
Steam turbine 4
Gas engine 5

COL. 38 COOLING TOWER
Cooling tower 1
Air-cooled 2

* Indicates starting point for that item only. All other items are right justified.

Figure 13 (cont'd)

D BUILDING CONSTRUCTION MECHANICAL SYSTEMS SCHEDULE

		DESCR: YEAR OPENED	DESCR: PLAN	DESCR: # EXT CLASSRMS	DESCR: # BLDGS	FLOOR AREA SQ FT	ROOF: ROOF AREA SQ FT	ROOF: SKYLIGHT AREA SQ FT	ROOF: ROOF CODE	WALL: CODE	WALL: EXT DOORS	LIGHTS: WATTS/ SQ FT	LIGHTS: TYPE	WINDOW AREA: GL-BLK DBL-GL SQ FT	WINDOW AREA: SINGLE GLASS SQ FT	WINDOW AREA: COND	TEMP: DAY	TEMP: NIGHT	MECHANICAL SYSTEMS: NON AIR TYPE	AIR: HEAT	AIR: SUPPLY	AIR: EXHAUST	COOL: HEAT	COOL: % COOLED	COOL: SOURCE	COOL: REHEAT	# AIR UNITS	MON - FRI: REG DAYS/WK	MON - FRI: REG HRS/ DAY	MON - FRI: SUMMER DAYS/ YEAR	MON - FRI: SUMMER DAYS/WK	MON - FRI: SUMMER HR./DAY	MON - FRI: SUMMER % USED	SAT - SUN: DAYS/ YEAR	SAT - SUN: HRS/DAY	SAT - SUN: % USED	EVENING: NIGHTS/ YEAR	EVENING: HRS/DAY	EVENING: % USED
AUDITORIUM	11	26	6			4000	4000		94	22		1					7065		21	3						5	3							216	3	
GYMNASIUM	21	60	1			9200	9200	3205	55	22		1.73					6565		21	4						5	6							216	3	
FIELD HOUSE	26	75	1			16300	16300	1505	55	11		1.13			522	6	5		21	3						5	6							216	3	
SHOWER/L	31	60	3			4652	4652		55	22		2			1602		7065		1113							5	6							216	3	
SHOWER/L	31	75	7			2000						1					7065		21	3						5	6							216	3	
WOOD SHOP	44	26	6			2040				22		2			3062		7065		11431							5	7									
METAL SHOP	45	26	6			2040				22		2			3062		7065		11431							5	7									
CAFETERIA	61	60	6			3328				22		2			5302		7065		431							5	6	30	5	3		36	3			
KITCHEN	60	60	6			896				22		2			1922		7065		431							5	7									
CONNECTING CORRIDOR	80																																				
GEN'L AREA 1	81	26	2	2	7	52920	31548		94	22		1.12			1532		7065		11	1	12		35			5	7									
GEN'L AREA 2	82	60	2	2	7	48580	19380	1125	55	22		1.62			1472		7065		431							5	7	30	5	3	1					
GEN'L AREA 3	83	74	2	8	1	11000	5500		55	22		2.02			902		7065		431		22					5	7									
GEN'L AREA 4	84																																				
PORTABLES	89																																				

ANSWER FOR TYPICAL CLASSROOM

TOTAL FLOOR AREA (MUST = A 38) 156956

PSECS PUBLIC SCHOOLS ENERGY CONSERVATION SERVICE

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(415) 854-2300

BOX D

COL. 13 PLAN TYPE
(Special Spaces Lines 11 & 21)
Freestanding 1
Attached by short side 2
Attached by long side 3
Attached by two sides 4
Partially enclosed (3 or more sides) 5
Attached by 3 sides or fully enclosed 6
Basement 7
(Gen'l Areas Lines 81 to 89)
Single-loaded corridor 1
Double-loaded corridor 2
Compact, big room, pods 3
As 3 but with interior courts 4

COL. 33, 35 ROOF, WALL INSULATION
See Appendices 1 and 2 for codes

COL. 41 LIGHTING TYPE
Incandescent 1
Fluorescent 2
Mercury-vapor, other HID 3

COL. 49 WINDOW CONDITION
Tight ht. little air leakage 1
Medium ht. some air leakage 2
Loose ht. great air leakage 3

NON-OUTSIDE AIR SYSTEMS
COL. 54 TYPE
Radiators, radiant panels 1
Unit heater(s), fan coil unit(s) 2
Furnace(s) 3
Heat pump(s) 8

COL. 55 & 58 HEAT SOURCE
Hot water or steam, Boiler Group 1 1
Hot water or steam, Boiler Group 2 2
Electric coils 3
Direct-fired gas 4
Direct-fired oil 5
Small packaged boilers 7
Hot water or steam, Boiler Group 3 8
Hot water or steam, Boiler Group 4 9
Not heated (58 only) blank

AIR SYSTEMS
COL. 56 SUPPLY
Windows only blank
Transfer air 1
House fans 2
Unit ventilators 4
Single duct, single zone 5
Heat pump(s) 6
Multizone, dual duct 7
Variable volume 8

COL. 57 EXHAUST
Windows only blank
Gravity relief 1
Powered fans 3
Transfer air 4
Return to system - ducted 5
Return to system - plenum 6

COL. 59 HEAT SOURCE
(See COL. 55)

COOLING
COL. 59 PER CENT COOLED
0 to 10 per cent blank
11 to 25 per cent 1
26 to 50 per cent 2
51 to 75 per cent 3
76 to 100 per cent 4

COL. 60 COOLING SOURCE
Direct expansion (DX) 1
Chilled water from chiller #1 2
Chilled water from chiller #2 3
Evaporative (swamp) cooler(s) 5
Heat pump 6
Chilled water from chiller #3 8
Chilled water from chiller #4 9

COL. 61 REHEAT
Steam 1
Hot water 2
Electricity 3
Hot refrigerant gas 4

COL. 71, 75, 80 PER CENT USED
1 to 25 per cent 1
26 to 50 per cent 2
51 to 75 per cent 3
76 to 100 per cent 4

PUBLIC SCHOOLS ENERGY CONSERVATION SERVICE

ENERGY MANAGEMENT REPORTS PS-5 AND PS-8

THESE REPORTS WERE PREPARED ON 8/29/78 AT THE REQUEST OF

JOHN Q PUBLIC
SAMPLE DISTRICT
123 MAIN STREET
ANYTOWN NY 12345

BY

EFL/SLC
1572 SOUTH 1400 EAST
SALT LAKE CITY UT 84105
PHONE 801-484-6041

THE FOLLOWING RENOVATION COSTS WERE USED TO ESTIMATE CAPITAL COSTS
THE PS-8C SURVEY OF MODIFICATIONS

CAPITAL MODIFICATION	COSTING UNIT	COST PER UNIT
REPLACE EXISTING LIGHTING		
WITH IMPROVED FLUORESCENT	SQUARE FOOT	$ 1.00
WITH HID TYPE SYSTEM	SQUARE FOOT	$ 1.00
DAMPER GRAVITY RELIEFS	SQUARE FOOT	$ .05
SEAL WINDOWS	SQUARE FOOT OF WINDOW	$ .60
REDUCE GLASS AREA (REPLACE WITH INSULATED PANEL)		
PRE-1945 SCHOOL	SQUARE FOOT OF WINDOW	$ 10.25
POST-WAR SCHOOL	SQUARE FOOT OF WINDOW	$ 4.25
DOUBLE GLAZE WINDOWS		
PRE-1945 SCHOOL	SQUARE FOOT OF WINDOW	$ 13.85
POST-WAR SCHOOL	SQUARE FOOT OF WINDOW	$ 8.45
INCREASE ROOF INSULATION (4 METHODS)		
1. BLOW WOOL INTO ATTIC	SQUARE FOOT OF ROOF	$ .00 + $ .02/R
2. BATTS ABOVE EXIST CEILG	SQUARE FOOT OF ROOF	$ .00 + $ .05/R
3. RIGID INSULATION,REROOF	SQUARE FOOT OF ROOF	$ .75 + $ .12/R
4. SUSPEND CEILING + BATTS	SQUARE FOOT OF ROOF	$ .00 + $ .12/R
RADIATION SETBACK BY THERMOSTAT	BOILER SET	$ 300.00
ADD AIRSYSTEM SETBACK	AIR HANDLING UNIT	$ 300.00
ELIMINATE MULTIZONE OVERLAP	AIR HANDLING UNIT	$ 425.00
REPLACE ABSORPTION CHILLERS WITH CENTRIFUGAL UNITS	TON OF COOLING	$ 485.00
INSTALL SEPARATE DOMESTIC HOT WATER HEATERS	STUDENT	$ 1.00
INSTALL MODULAR BOILERS	BOILER INPUT MBH	$ 16.85
MODIFY PUMPS FOR SEQUENCED OR VARIABLE SPEED OPERATION	BOILER SET	$4206.00
COVER SWIMMING POOL	SQUARE FOOT OF POOL SURFACE	$ 1.40

APPENDIX F

F1

PS-8C PSECS SURVEY OF MODIFICATIONS FOR SAMPLE DISTRICT 500 8/29/78

1 ELEMENTARY AREA 47900. SQUARE FEET

MODIFICATIONS AND PAYOFF PERIODS

MODIFICATION	ESTIMATED CAPITAL COST	ESTIMATED ANNUAL SAVINGS TOTAL DOLLARS	ELECTRICITY DOLLARS	ELECTRICITY KWH	HEATING FUEL DOLLARS	HEATING FUEL UNITS	PAYOFF PERIOD AT FUEL ESCALATION OF 0. PERCENT PAYG	0. PERCENT BOND	10. PERCENT PAYG	10. PERCENT BOND	20. PERCENT PAYG	20. PERCENT BOND
AUDITORIUM (1966)												
REDUCE LIGHTING 51. PCT		$ 369.	$ 460.	14365.	$ -91.	-227.						
OR												
REPLACE LIGHTING WITH .6 WSF MID-TYPE	$ 4200.	$ 568.	$ 708.	22130.	$ -140.	-350.	7.4	12.9	5.8	8.7	5.0	7.0
ROOF INSULATION (METHOD 3) INCREASE BY R=11.1	$ 8517.	$ 102.	$ 0.	0.	$ 102.	255.	83.6	****	23.5	28.8	15.7	18.7
SET DAY STATS AT 65.		$ 9.	$ 0.	0.	$ 9.	23.						
SET NIGHT STATS AT 55.		$ 43.	$ 0.	0.	$ 43.	108.						
MARGINAL HR/DAY-REG SES		$ 78.	$ 62.	1931.	$ 16.	40.						
GYMNASIUM (1966)												
REDUCE LIGHTING 2. PCT		$ 23.	$ 29.	909.	$ -6.	-14.						
OR												
REPLACE LIGHTING WITH 1.2 WSF MID-TYPE	$ 5800.	$ 557.	$ 694.	21687.	$ -137.	-343.	10.4	18.2	7.5	10.9	6.2	8.4
SET DAY STATS AT 65.		$ 13.	$ 0.	0.	$ 13.	32.						
SET NIGHT STATS AT 55.		$ 60.	$ 0.	0.	$ 60.	149.						
MARGINAL HR/DAY-REG SES		$ 157.	$ 135.	4221.	$ 22.	55.						
GENERAL AREA (1966)												
REDUCE GLASS BY 50. PCT	$ 5100.	$ 346.	$ 0.	0.	$ 346.	865.	14.7	25.7	9.5	13.3	7.5	10.0
20279.9998	8.4500		.0633	37900.0000								
DOUBLE GLAZE WINDOWS	$ 20280.	$ 322.	$ 0.	0.	$ 322.	806.	62.9	****	20.8	26.0	14.3	17.2
ROOF INSULATION (METHOD 3) INCREASE BY R= 9.0	$ 67540.	$ 743.	$ 0.	0.	$ 743.	1856.	91.0	****	24.2	29.6	16.2	19.1
SET NIGHT STATS AT 55.		$ 1027.	$ 0.	0.	$ 1027.	2566.						
MARGINAL HR/DAY-REG SES		$ 381.	$ 349.	10917.	$ 32.	79.						
PLANT SUMMARY												
SEPARATE WATER HEATERS	$ 400.	$ 1016.	$ 0.	0.	$ 1016.	2540.	.4	.7	.4	.7	.4	.7

SEQUENCED PUMPS	$ 4206.	$ 1534.	$ 1534.	47939.	$ 0.	0.	2.7	4.8	2.5	4.1	2.4	3.7

****

FUEL TYPE AND UNITS ARE #6 OIL GALLONS AT $ .400
ELECTRICITY KWH AT $ .032

PAYG = PAY AS YOU GO FINANCING FROM OPERATING FUNDS

BOND = FUNDS OBTAINED THROUGH SALE OF 20-YEAR BONDS AT 6.0 PER CENT

F3

** PS-8 SELF-HELP AUDIT PROGRAM **

8/29/78

PS8A ENERGY CONSERVATION REPORT ON-

PLANT NAME ELEMENTARY K-8
STATE ID. 500 1
DISTRICT SAMPLE DISTRICT

AREA 47900. SQUARE FEET 1976/1977 ENROLLMENT 400.

DURING 1976/1977 PORTIONS OF THIS SCHOOL WERE USED FOR THE SCHOOL DAY PLUS

5.NIGHTS PER WEEK, FOR 9. WKS/SUMMER

**********ENERGY SAVINGS**********

FOR THIS SCHOOL *PSECS* ESTIMATES THAT ENERGY USE REDUCTIONS OF

.0 PER CENT IN ELECTRICITY
21.6 PER CENT IN OTHER FUELS

ARE POSSIBLE WITHOUT CHANGING EDUCATIONAL OR COMMUNITY USE AND WITH LITTLE OR NO ADDITIONAL EXPENDITURE

		ACTUAL USE 1976/1977	GUIDELINE 1976/1977	ESTIMATED SAVINGS
#6 FUEL OIL	GALLONS	30009.	23540.	6469.
				$ 2588.
ELECTRICITY	KWH	192300.	247679.	0.
				$ 0.
TOTAL ESTIMATED SAVINGS				$ 2588.

THESE ESTIMATES ARE BASED UPON A COMPARISON OF THIS PLANT WITH THE PSECS COMPUTER MODEL ADJUSTED FOR LOCATION AND GENERAL USE. UNUSUAL DESIGN FEATURES MAY INVALIDATE THESE FINDINGS.

****

SPACE TYPE	LIGHTING WATTS/SQ FT IN USE ACTUAL	LIGHTING WATTS/SQ FT IN USE PSECS	SEE HEAT NOTE	HEATING SYSTEM SPACE TEMPERATURE ON REGULAR ACTUAL	ON REGULAR PSECS	ON SETBACK ACTUAL	ON SETBACK PSECS	HEATING SYSTEM HOURS PER WEEK ON REGULAR ACTUAL	ON REGULAR PSECS	ON SETBACK ACTUAL	ON SETBACK PSECS	COOLING SYSTEM SPACE TEMPERATURE ACTUAL	COOLING SYSTEM SPACE TEMPERATURE PSECS	COOLING SYSTEM HOURS PER WEEK ACTUAL	COOLING SYSTEM HOURS PER WEEK PSECS
AUDITORIUM	2.9	1.4	2	68.F	65.F	65.F	55.F		49.		119.				
GYMNASIUM	2.9	2.8	2	68.F	65.F	65.F	55.F		49.		119.				
GENERAL AREA 1966	1.7	1.7	2	68.F	68.F	65.F	55.F		39.		129.				
CORRIDORS	1.7	1.0	2	68.F	60.F	65.F	55.F		39.		129.				

NOTES TO TABLE

NOTE 2. SYSTEM PUT ON NIGHT SETTING FROM END OF DAILY USE TO START OF WARM UP ON NEXT DAY OF USE. OUTSIDE DAMPERS SHUT DURING THIS PERIOD. SETBACK MAY BEGIN AS EARLY AS 2PM IF EXPERIMENTATION INDICATES ADEQUATE BUILDING HEAT RETENTION.

AIR SYSTEM OPERATING CONDITIONS

HEATING: SUPPLY OR MIXED AIR TEMPERATURE 60F

SUPPLY AIR:	SPECIAL USE SPACES	1.5 CFM/SQ FT
	UNIT GENERAL AREAS	1.2 CFM/SQ FT
FRESH AIR:	SPECIAL USE SPACES	AS REPORTED
	UNIT GENERAL AREAS	7.5 CFM/PUPIL

DEFINITIONS OF TERMS USED

REG = OCCUPIED CONDITIONS. SO-CALLED DAY SETTING.
SETBACK = UNOCCUPIED CONDITIONS. NIGHT SETTING.

**********MECHANICAL SYSTEM**********

THIS SECTION CONTAINS SUGGESTIONS FOR REDUCING ENERGY WASTAGE IN THE MAINTENANCE AND OPERATIONS OF THE MECHANICAL PLANT. COST AND ENERGY SAVINGS PROFILES FOR SOME OF THESE SUGGESTIONS CAN BE FOUND IN PS-8C TABLE OF MODIFICATIONS.

BOILER GROUP #1

	USE HOURS DETERMINED BY	KBTU RATING	EFFICIENCY ACTUAL	EFFICIENCY GUIDE	BASE YEAR HOURS ACTUAL	BASE YEAR HOURS GUIDE
BOILER #1	DHW SUPPLY	5020.	0.	80.	6480.	3330.
BOILER #2	DHW SUPPLY	5020.	0.	80.	6480.	1038.

MEASURE AND ADJUST COMBUSTION FOR MAXIMUM EFFICIENCY, AFTER ADJUSTMENT EFFICIENCY OF EACH BOILER SHOULD APPROACH GUIDELINE.

BOILERS USED FOR SPACE HEATING AND DOM HOT WATER-

FIRE LEAD BOILER ONLY DURING OCCUPIED HOURS WINTER AND SUMMER AND DURING HEATING SEASON WHEN OVERNIGHT TEMPERATURES BELOW 40F ARE EXPECTED. SET DOMESTIC HOT WATER TEMPERATURE AT 115F, BOOST AS REQUIRED. SEE TABLE OF MODIFICATIONS FOR SEPARATE HOT WATER HEATERS.

FIRE FIRST BACK-UP BOILER ONLY WHEN LOAD IS TOO GREAT FOR LEAD BOILER ALONE. THIS WILL PROBABLY OCCUR BELOW 32F IN THE HEATING SEASON.

ALL BOILERS GENERAL SUGGESTIONS-

1. TEST AND ADJUST COMBUSTION EFFICIENCY ANNUALLY.
2. CLEAN, REPAIR AND ADJUST BOILERS ANNUALLY.
3. CLEAN, REPAIR AND ADJUST AUXILIARIES ANNUALLY.

****

PS-BC PSECS SURVEY OF MODIFICATIONS FOR SAMPLE DISTRICT 500 8/29/78

001 HIGH SCHOOL AREA 156956, SQUARE FEET

**********MODIFICATIONS AND PAYOFF PERIODS**********

MODIFICATION	ESTIMATED CAPITAL COST	ESTIMATED ANNUAL SAVINGS TOTAL DOLLARS	ELECTRICITY DOLLARS	ELECTRICITY KWH	HEATING FUEL DOLLARS	HEATING FUEL UNITS	PAYOFF PERIOD AT FUEL ESCALATION OF 0. PERCENT PAYG	0. PERCENT BOND	10. PERCENT PAYG	10. PERCENT BOND	20. PERCENT PAYG	20. PERCENT BOND
**********AUDITORIUM (1926)**********												
REPLACE LIGHTING WITH .6 WSF MID-TYPE	$ 4000.	$ 161.	$ 203.	6330.	$ -42.	-104.	24.9	43.3	13.1	17.6	9.8	12.4
ROOF INSULATION (METHOD 1) INCREASE BY R= 2.4	$ 143.	$ 12.	$ 0.	0.	$ 12.	29.	12.3	21.4	8.4	12.0	6.8	9.1
SET DAY STATS AT 65.		$ 5.	$ 0.	0.	$ 5.	12.						
SET NIGHT STATS AT 60.		$ 16.	$ 0.	0.	$ 16.	41.						
MARGINAL HR/DAY-REG SES		$ 35.	$ 35.	1079.	$ 0.	0.						
**********GYMNASIUM (1960)**********												
REDUCE LIGHTING 28. PCT		$ 280.	$ 353.	11018.	$ -72.	-181.						
OR REPLACE LIGHTING WITH 1.2 WSF MID-TYPE	$ 9200.	$ 280.	$ 353.	11018.	$ -72.	-181.	32.8	57.3	15.3	20.0	11.1	13.8
ROOF INSULATION (METHOD 3) INCREASE BY R= 9.0	$ 15825.	$ 181.	$ 0.	0.	$ 181.	451.	87.6	****	23.9	29.3	16.0	18.9
SET NIGHT STATS AT 60.		$ 126.	$ 0.	0.	$ 126.	314.						
MARGINAL HR/DAY-REG SES		$ 69.	$ 69.	2150.	$ 0.	0.						
**********FIELD HOUSE (1975)**********												
SEAL WINDOWS	$ 31.	$ 1.	$ 0.	0.	$ 1.	1.	52.4	91.4	19.2	24.3	13.4	16.2
REDUCE GLASS BY 50. PCT	$ 110.	$ 7.	$ 0.	0.	$ 7.	16.	16.8	29.3	10.3	14.4	8.1	10.5
439.4000	8.4500		.0032	16300.0000								
DOUBLE GLAZE WINDOWS	$ 439.	$ 6.	$ 0.	0.	$ 6.	15.	71.8	****	22.0	27.3	15.0	17.9
MARGINAL HR/DAY-REG SES		$ 109.	$ 109.	3407.	$ 0.	0.						
**********SHOWER/LOCKER (1960)**********												
SEAL WINDOWS	$ 96.	$ 6.	$ 0.	0.	$ 6.	15.	16.4	28.5	10.2	14.2	8.0	10.4
REDUCE GLASS BY 50. PCT	$ 340.	$ 36.	$ 0.	0.	$ 36.	90.	9.4	16.4	7.0	10.2	5.8	8.0

F7

1352.0000	8.4500		.0344	4652.0000										
DOUBLE GLAZE WINDOWS	$ 1352.	$ 34.	$ 0.	0.	$ 34.	84.	40.2	70.1	16.9	21.8	12.1	14.9		
ROOF INSULATION (METHOD 3) INCREASE BY R= 9.0	$ 8290.	$ 142.	$ 0.	0.	$ 142.	356.	58.2	****	20.1	25.3	13.9	16.8		
RADIATION SETBACK	$ 300.	$ 0.	$ 0.	0.	$ 634.	1584.	.0	.0	.0	.0	.0	.0		
SET NIGHT STATS AT 60.		$ 96.	$ 0.	0.	$ 96.	239.								
MARGINAL HR/DAY-REG SES		$ 51.	$ 51.	1591.	$ 0.	0.								
**********SHOWER/LOCKER (1975)**********														
REPLACE LIGHTING WITH .8 WSF FLUORESNT	$ 2000.	$ 141.	$ 178.	5555.	$ -36.	-91.	14.2	24.7	9.2	13.0	7.3	9.8		
RADIATION SETBACK	$ 300.	$ 0.	$ 0.	0.	$ 24.	60.	.0	.0	.0	.0	.0	.0		
SET NIGHT STATS AT 60.		$ 4.	$ 0.	0.	$ 4.	11.								
MARGINAL HR/DAY-REG SES		$ 23.	$ 23.	718.	$ 0.	0.								
**********WOOD SHOP (1926)**********														
SEAL WINDOWS	$ 184.	$ 12.	$ 0.	0.	$ 12.	29.	15.6	27.3	9.9	13.8	7.8	10.2		
REDUCE GLASS BY 50. PCT	$ 1568.	$ 46.	$ 0.	0.	$ 46.	114.	34.3	59.7	15.6	20.4	11.3	14.0		
4238.0999	13.8500		.1500	2040.0000										
SET DAY STATS AT 68.		$ 10.	$ 0.	0.	$ 10.	26.								
SET NIGHT STATS AT 55.		$ 34.	$ 0.	0.	$ 34.	86.								
MARGINAL HR/DAY-REG SES		$ 98.	$ 40.	1260.	$ 58.	144.								
**********METAL SHOP (1926)**********														
SEAL WINDOWS	$ 184.	$ 12.	$ 0.	0.	$ 12.	29.	15.6	27.3	9.9	13.8	7.8	10.2		
REDUCE GLASS BY 50. PCT	$ 1568.	$ 46.	$ 0.	0.	$ 46.	114.	34.3	59.7	15.6	20.4	11.3	14.0		
4238.0999	13.8500		.1500	2040.0000										
SET DAY STATS AT 68.		$ 10.	$ 0.	0.	$ 10.	26.								
SET NIGHT STATS AT 55.		$ 34.	$ 0.	0.	$ 34.	86.								
MARGINAL HR/DAY-REG SES		$ 98.	$ 40.	1260.	$ 58.	144.								
**********CAFETERIA (1960)**********														
SEAL WINDOWS	$ 318.	$ 13.	$ 0.	0.	$ 13.	32.	24.7	43.0	13.0	17.5	9.7	12.4		

REDUCE GLASS BY 50. PCT	$ 1126.	$ 79.	$ 0.	0.	$ 79.	198.	14.2	24.8	9.3	13.1	7.4	9.8
4476.4999	8.4500		.1593	3328.0000								
DOUBLE GLAZE WINDOWS	$ 4478.	$ 74.	$ 0.	0.	$ 74.	185.	60.6	****	20.5	25.7	14.1	17.0
SET DAY STATS AT 68.		$ 16.	$ 0.	0.	$ 16.	40.						
SET NIGHT STATS AT 55.		$ 56.	$ 0.	0.	$ 56.	140.						
MARGINAL HR/DAY-REG SES		$ 189.	$ 80.	2494.	$ 109.	272.						
**********				KITCHEN (1960)								
SEAL WINDOWS	$ 115.	$ 5.	$ 0.	0.	$ 5.	11.	25.4	44.4	13.3	17.8	9.9	12.5
REDUCE GLASS BY 50. PCT	$ 408.	$ 28.	$ 0.	0.	$ 28.	70.	14.6	25.5	9.5	13.3	7.5	9.9
1622.4000	8.4500		.2143	896.0000								
DOUBLE GLAZE WINDOWS	$ 1622.	$ 26.	$ 0.	0.	$ 26.	65.	62.5	****	20.8	26.0	14.3	17.1
SET DAY STATS AT 68.		$ 5.	$ 0.	0.	$ 5.	12.						
SET NIGHT STATS AT 55.		$ 18.	$ 0.	0.	$ 18.	46.						
MARGINAL HR/DAY-REG SES		$ 44.	$ 19.	581.	$ 25.	63.						
**********				GENERAL AREA (1926)								
DAMPER GRAVITY RELIEFS AND	$ 2646.	$ 4146.	$ 0.	0.	$ 4146.	10364.	.6	1.1	.6	1.1	.6	1.1
SEAL WINDOWS	$ 2479.	$ 159.	$ 0.	0.	$ 159.	396.	15.6	27.3	9.9	13.8	7.8	10.2
SEAL WINDOWS	$ 2479.	$ 317.	$ 0.	0.	$ 317.	793.	7.8	13.6	6.1	9.0	5.2	7.2
REDUCE GLASS BY 50. PCT	$ 21171.	$ 618.	$ 0.	0.	$ 618.	1545.	34.3	59.7	15.6	20.4	11.3	14.0
57214.3486	13.8500		.0781	52920.0000								
ROOF INSULATION (METHOD 1) INCREASE BY R= 2.4	$ 1127.	$ 92.	$ 0.	0.	$ 92.	229.	12.3	21.4	8.4	12.0	6.8	9.1
SET DAY STATS AT 68.		$ 97.	$ 0.	0.	$ 97.	242.						
SET NIGHT STATS AT 60.		$ 690.	$ 0.	0.	$ 690.	1724.						
MARGINAL HR/DAY-REG SES		$ 305.	$ 305.	9532.	$ 0.	0.						
**********				GENERAL AREA (1960)								
SEAL WINDOWS	$ 2381.	$ 97.	$ 0.	0.	$ 97.	241.	24.7	43.0	13.0	17.5	9.7	12.4

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REDUCE GLASS BY 50. PCT	$ 8434.	$ 594.	$ 0.	0.	$ 594.	1485.	14.2	24.8	9.3	13.1	7.4	9.8
33538.0493	8.4500		.0817	48580.0000								
DOUBLE GLAZE WINDOWS	$ 33538.	$ 553.	$ 0.	0.	$ 553.	1384.	60.6	****	20.5	25.7	14.1	17.0
ROOF INSULATION (METHOD 3) INCREASE BY R= 9.0	$ 343.7.	$ 392.	$ 0.	0.	$ 392.	980.	87.6	****	23.9	29.3	16.0	18.9
SET DAY STATS AT 68.		$ 92.	$ 0.	0.	$ 92.	230.						
SET NIGHT STATS AT 55.		$ 1220.	$ 0.	0.	$ 1220.	3050.						
MARGINAL HR/DAY-REG SES		$ 470.	$ 428.	13365.	$ 42.	105.						
**********				*GENERAL AREA (1974)*								
SEAL WINDOWS	$ 432.	$ 18.	$ 0.	0.	$ 18.	44.	24.7	43.0	13.0	17.5	9.7	12.4
REDUCE GLASS BY 50. PCT	$ 1530.	$ 108.	$ 0.	0.	$ 108.	269.	14.2	24.8	9.3	13.1	7.4	9.8
6083.9999	8.4500		.0655	11000.0000								
DOUBLE GLAZE WINDOWS	$ 6084.	$ 100.	$ 0.	0.	$ 100.	251.	60.6	****	20.5	25.7	14.1	17.0
ROOF INSULATION (METHOD 3) INCREASE BY R= 9.0	$ 9801.	$ 112.	$ 0.	0.	$ 112.	280.	87.6	****	23.9	29.3	16.0	18.9
SET DAY STATS AT 68.		$ 20.	$ 0.	0.	$ 20.	49.						
SET NIGHT STATS AT 55.		$ 260.	$ 0.	0.	$ 260.	649.						
MARGINAL HR/DAY-REG SES		$ 125.	$ 115.	3595.	$ 10.	24.						
**********				*PLANT SUMMARY*								
SEPARATE WATER HEATERS	$ 1050.	$ 2677.	$ 0.	0.	$ 2677.	6693.	.4	.7	.4	.7	.4	.7

FUEL TYPE AND UNITS ARE #4 OIL GALLONS AT $ .400
ELECTRICITY KWH AT $ .032

PAYG = PAY AS YOU GO FINANCING FROM OPERATING FUNDS

BOND = FUNDS OBTAINED THROUGH SALE OF 20-YEAR BONDS AT 6.0 PER CENT

** PS-8 SELF-HELP AUDIT PROGRAM **

6/29/78

PS8A ENERGY CONSERVATION REPORT ON-

PLANT NAME HIGH SCHOOL 9-12
STATE ID. 500 601

DISTRICT SAMPLE DISTRICT

AREA 156956. SQUARE FEET 1976/1977 ENROLLMENT 1050.

DURING 1976/1977 PORTIONS OF THIS SCHOOL WERE USED FOR THE SCHOOL DAY PLUS

5. NIGHTS PER WEEK, FOR WEEKEND ACTIVITIES, FOR 6. WKS/SUMMER

**********ENERGY SAVINGS**********

FOR THIS SCHOOL *PSECS* ESTIMATES THAT ENERGY USE REDUCTIONS OF

35.2 PER CENT IN ELECTRICITY
29.9 PER CENT IN OTHER FUELS

ARE POSSIBLE WITHOUT CHANGING EDUCATIONAL OR COMMUNITY USE AND WITH LITTLE OR NO ADDITIONAL EXPENDITURE

		ACTUAL USE 1976/1977	GUIDELINE 1976/1977	ESTIMATED SAVINGS
#4 FUEL OIL	GALLONS	92890.	65162.	27728.
				$ 11091.
ELECTRICITY	KWH	725800.	470604.	255196.
				$ 8166.
TOTAL ESTIMATED SAVINGS				$ 19257.

THESE ESTIMATES ARE BASED UPON A COMPARISON OF THIS PLANT WITH THE PSECS COMPUTER MODEL ADJUSTED FOR LOCATION AND GENERAL USE. UNUSUAL DESIGN FEATURES MAY INVALIDATE THESE FINDINGS.

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**********PS8B SELF-AUDIT CRITERIA FOR HIGH SCHOOL 9-12**********

SPACE TYPE	LIGHTING WATTS/SQ FT IN USE ACTUAL	PSECS	SEE NOTE	HEATING SYSTEM SPACE TEMPERATURE ON REGULAR ACTUAL	PSECS	ON SETBACK ACTUAL	PSECS	SYSTEM HOURS PER WEEK ON REGULAR ACTUAL	PSECS	ON SETBACK PSECS	COOLING SYSTEM SPACE TEMPERATURE ACTUAL	PSECS	HOURS PER WEEK ACTUAL	PSECS
AUDITORIUM	1.4	1.4		70.F	65.F	65.F	60.F	39.	129.					
GYMNASIUM	1.7	1.2		65.F	65.F	65.F	60.F	54.	114.					
FIELD HOUSE	1.1	1.1		65.F	65.F	0.F	60.F	54.	114.					
SHOWER/LOCKER	.8	.8		70.F	70.F	65.F	60.F	54.	114.					
SHOWER/LOCKER	1.9	1.9		70.F	70.F	65.F	60.F	54.	114.					
WOOD SHOP	2.8	2.8	2	70.F	68.F	65.F	55.F	44.	124.					
METAL SHOP	2.8	2.8	2	70.F	68.F	65.F	55.F	44.	124.					
CAFETERIA	3.2	3.2	2	70.F	68.F	65.F	55.F	42.	126.					
KITCHEN	3.2	3.2	2	70.F	68.F	65.F	55.F	44.	124.					
GENERAL AREA 1926	1.1	1.1		70.F	68.F	65.F	60.F	44.	124.					
CORRIDORS	1.1	1.0		70.F	60.F	65.F	60.F	44.	124.					
GENERAL AREA 1960	1.6	1.6	2	70.F	68.F	65.F	55.F	44.	124.					
CORRIDORS	1.6	1.0	2	70.F	60.F	65.F	55.F	44.	124.					
GENERAL AREA 1974	2.0	2.0	2	70.F	68.F	65.F	55.F	44.	124.		78.F		40.	
CORRIDORS	2.0	1.0	2	70.F	60.F	65.F	55.F	44.	124.		78.F		40.	

**********NOTES TO TABLE**********

NOTE 2. SYSTEM PUT ON NIGHT SETTING FROM END OF DAILY USE TO START OF WARM UP ON NEXT DAY OF USE. OUTSIDE DAMPERS SHUT DURING THIS PERIOD. SETBACK MAY BEGIN AS EARLY AS 2PM IF EXPERIMENTATION INDICATES ADEQUATE BUILDING HEAT RETENTION.

SHUT COOLING SYSTEM OFF DURING UNOCCUPIED HOURS. MAKE MAXIMUM USE OF FREE COOLING BY RUNNING AIR SYSTEM WITH CHILLERS OFF.

AIR SYSTEM OPERATING CONDITIONS

HEATING: SUPPLY OR MIXED AIR TEMPERATURE 60F
SUPPLY AIR: SPECIAL USE SPACES 1.5 CFM/SQ FT
UNIT GENERAL AREAS 1.2 CFM/SQ FT
FRESH AIR: SPECIAL USE SPACES AS REPORTED

	UNIT GENERAL AREAS	7.5 CFM/PUPIL
COOLING: SUPPLY OR MIXED AIR TEMPERATURE		60F
SUPPLY AIR	AS FOR HEATING	
FRESH AIR:	SPECIAL USE SPACES	33 PER CENT
	UNIT GENERAL AREAS	7.5 CFM/PUPIL

DEFINITIONS OF TERMS USED

REG = OCCUPIED CONDITIONS. SO-CALLED DAY SETTING.
SETBACK = UNOCCUPIED CONDITIONS. NIGHT SETTING.

****

**********MECHANICAL SYSTEM**********

THIS SECTION CONTAINS SUGGESTIONS FOR REDUCING ENERGY WASTAGE IN THE MAINTENANCE AND OPERATIONS OF THE MECHANICAL PLANT. COST AND ENERGY SAVINGS PROFILES FOR SOME OF THESE SUGGESTIONS CAN BE FOUND IN PS-8C TABLE OF MODIFICATIONS.

BOILER GROUP #1

	USE HOURS DETERMINED BY	KBTU RATING	EFFICIENCY ACTUAL	EFFICIENCY GUIDE	BASE YEAR HOURS ACTUAL	BASE YEAR HOURS GUIDE
BOILER #1	DHW SUPPLY	4185.	0.	80.	5928.	3330.
BOILER #2	DHW SUPPLY	4185.	0.	80.	5928.	1038.

MEASURE AND ADJUST COMBUSTION FOR MAXIMUM EFFICIENCY, AFTER ADJUSTMENT EFFICIENCY OF EACH BOILER SHOULD APPROACH GUIDELINE.

BOILERS USED FOR SPACE HEATING AND DOM HOT WATER-

FIRE LEAD BOILER ONLY DURING OCCUPIED HOURS WINTER AND SUMMER AND DURING HEATING SEASON WHEN OVERNIGHT TEMPERATURES BELOW 40F ARE EXPECTED. SET DOMESTIC HOT WATER TEMPERATURE AT 115F, BOOST AS REQUIRED. SEE TABLE OF MODIFICATIONS FOR SEPARATE HOT WATER HEATERS.

FIRE FIRST BACK-UP BOILER ONLY WHEN LOAD IS TOO GREAT FOR LEAD BOILER ALONE. THIS WILL PROBABLY OCCUR BELOW 32F IN THE HEATING SEASON.

ALL BOILERS GENERAL SUGGESTIONS-

1. TEST AND ADJUST COMBUSTION EFFICIENCY ANNUALLY.
2. CLEAN, REPAIR AND ADJUST BOILERS ANNUALLY.
3. CLEAN, REPAIR AND ADJUST AUXILIARIES ANNUALLY.

CENTRAL PLANT CHILLERS-

OPERATE CHILLERS ONLY DURING HOURS OF PROGRAM USE WHEN COOLING IS REQUIRED. MAKE MAXIMUM USE OF FREE COOLING BY USING OUTSIDE AIR WITHOUT CHILLERS WHENEVER POSSIBLE. CLEAN, ADJUST AND REPAIR CHILLERS ANNUALLY.

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PS-5 PSECS SUMMARY REPORT ON ENERGY CONSERVATION FOR 8/29/78

DISTRICT NAME SAMPLE DISTRICT
DISTRICT ADDRESS 125 MAIN STREET
ANYTOWN NY 12345
ENERGY MANAGER JOHN Q PUBLIC

STATE ID# 500

DISTRICT DATA 1976/1977 0. CLG D-D 5685. HTG D-D

			ELECTRIC ENERGY 1976/1977					FUEL ENERGY 1976/1977					
			KBTU/SQ FT/YEAR			SAVINGS		KBTU/SQ FT/YEAR			SAVINGS		TOTAL
PLANT	GRADES	AREA	ACTUAL	GUIDEL	SAVING	PCT	DOLLARS	ACTUAL	GUIDEL	SAVING	PCT	DOLLARS	SAVINGS
ELEMENTARY	K-8	47900.	13.70	17.65	.00	0.	$ 0.	94.29	73.96	20.33	22.	$ 2588.	$ 2588.
HIGH SCHOOL	9-12	156956.	15.78	10.23	5.55	35.	$ 8166.	85.81	60.20	25.62	30.	$ 11091.	$ 19257.
TOTALS	PLANTS (2)						$ 8166.					$ 13679.	$ 21845.

APPENDIX G

PARTICIPATING AGENCIES

New York State Energy Research and Development Authority

- Mel Singer

New York State Energy Office

- Brian Henderson

New York State Education Department - Division of Educational Facilities

- Stan Baltzel
- David Richards

New York State Education Department - Office of Educational Finance, Management and School Services

- Richard C. Lessor, Computer Services Coordinator

Nassau BOCES

- Dominick J. Mupo, Assistant Superintendent for General Services
- Robert Liquori, Director, Computer Center

Erie #1 BOCES

- Delbert H. Repp, Director of Computer Services
- Wayne Hughes, Planning/Instruction Services Division

School Districts

- Bedford
- Brewster
- Hendrick Hudson
- Niskayuna

Educational Facilities Laboratories, Inc.

- Alan C. Green, Project Administrator
- John R. Boice, Project Director
- Joshua A. Burns, Technical Director
- Steven Bedford, Research Associate
- Lorna Paisley, Administrative Assistant
- Nancy London, Intern